UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

May 30, 2003

Thomas F. Mueller
Seattle District, Corps of Engineers
Regulatory Branch - CENWS-OD-RG
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Act Essential Fish Habitat Consultation on the Tacoma Public Utilities Pipeline Number One Crossing of the White River, Washington (NMFS Tracking No. 2003/00453, Corps No. 1999-4-01589)

Dear Mr. Mueller:

NOAA's National Marine Fisheries Service's (NOAA Fisheries) Biological Opinion (Opinion) on the Tacoma Public Utilities Pipeline Number One Crossing of the White River, including issuance of the 404 Clean Water Act authorization. This Opinion was prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16U.S.C. 1531 *et seq.*) and the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996. NOAA Fisheries concludes in this Opinion that implementation of the proposed action is not likely to jeopardize the continued existence of Puget Sound chinook salmon. Please note that the incidental take statement (*Section 2.2* of the Opinion) includes nondiscretionary reasonable and prudent measures and terms and conditions designed to minimize take of Puget Sound chinook salmon. NOAA Fisheries also concludes that the project will adversely affect EFH for Pacific salmon; conservation recommendations can be found in Section 3.0 of the attached document.

The US. Army Corps of Engineers (COE) reinitiated formal consultation with NOAA Fisheries on April 21, 2003, after having determined that the proposed action was substantially modified after NOAA Fisheries' February 2002 Opinion was issued. New information revealed that the project may affect the Puget Sound chinook salmon *(Oncorhynchus tshawytscha)* Evolutionarily Significant Unit in a manner or to an extent not previously considered. This Opinion and EFH consultation is the result of an analysis of effects of the proposed action on threatened Puget

Sound chinook salmon in the White River, Washington. This Opinion and EFH consultation is based on information provided in the biological assessment and monitoring and contingency report sent to NOAA Fisheries by the COE and additional information from in a number of other supporting documents, emails and meetings.

A complete administrative record of this consultation is on file at the Washington State Habitat Branch Office. Questions regarding this consultation should be directed to Ann Garrett of my staff at (206) 526-6146.

Sincerely,

Russell M Strach for

D. Robert Lohn
Regional Administrator

Enclosure

cc: Jonathan Smith, COE
Glen George, Tacoma Water

Endangered Species Act - Section 7 Consultation
BIOLOGICAL OPINION
And
Magnuson-Stevens Fishery Conservation and Management Act
ESSENTIAL FISH HABITAT CONSULTATION

Tacoma Public Utilities
Pipeline Number One Crossing of the White River
King and Pierce Counties, Washington
NMFS Tracking No. 2003/00453

Agency: U.S. Army Corps of Engineers

Consultation Conducted by: National Marine Fisheries Service, Northwest Region

Approved by: Russell M Strach for Date: May 30, 2003

D. Robert Lohn
Regional Administrator

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1.0 INTRODUCTION

This Biological Opinion (Opinion) and Essential Fish Habitat (EFH) consultation responds to a request by United States Army Corps of Engineers (COE) to reinitiate consultation on their issuance of a permit pursuant to section 404 of the Clean Water Act to Tacoma Public Utilities (Tacoma) for the construction, maintenance, and repair of utility lines and associated facilities in waters of the United States (US). Tacoma proposes to replace a section of water pipeline (No. 1) and remove the associated concrete slab dam, which crosses the White River (Water Resource Inventory Area [WRIA] 10) at river mile (RM) 23.3 in King and Pierce Counties. The project area is within the Puget Sound chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) and contains EFH for Puget Sound chinook, coho *(O. kisutch),* and Puget Sound pink *(O. gorbuscha)* salmon.

This Opinion replaces the February 25, 2002, Opinion on this project, and is based upon the best scientific and commercial information available. Information is incorporated from (1) the February 25, 2002, Opinion, (2) the Revised Construction Approach and Contingency and Monitoring Plans (R2 Resource Consultants 2003), (3) the biological assessment (R2 Resource Consultants 2000), and (4) supplementary information detailed below.

1.1 Consultation History

On November 9, 2000, the COE submitted a request for formal consultation pursuant to section 7 of the Endangered Species Act (ESA).

On March 20, 2001, representatives of NOAA's National Marine Fisheries Service (NOAA Fisheries) met with Tacoma and the COE at the site of the pipeline project. At that time, NOAA Fisheries requested a copy of the project feasibility report, responses to questions from the US Fish and Wildlife Service (FWS), and additional information on the timing of salmon migrating through the action area.

On June 25, 2001, NOAA Fisheries received a multi-species periodicity chart, and a conceptual design for stabilizing the bank after the pipeline is installed and the dam removed. A copy of an early alternatives analysis was also submitted on this day.

On June 29, 2001, a feasibility report was submitted to NOAA Fisheries, which examined the three bridged alternative crossings using new and existing piers and a copy of Tacoma's response to FWS was sent on July 5, 2001 (S. Madsen, R2 Resource Consultants, pers. comm., 2001). Subsequently, NOAA Fisheries received additional information on chinook salmon returns on July 6, 2001.

On August 3, 2001, an EFH assessment was submitted pursuant to the Magnuson-Stevens Fishery Conservation Management Act, as amended.

On August 17, 2001, NOAA Fisheries learned that the proposed construction method of open trenching the White River may not be feasible under local regulations.

On August 21, 2001, King County Water and Land Resources Division submitted comments to Tacoma, NOAA Fisheries and the FWS (the Services) regarding the proposed project and their concerns about the feasibility of the water diversion, the potential for groundwater to destabilize the work area, and the changes to channel morphology that would result, among other issues.

On August 28, 2001, NOAA Fisheries requested that Tacoma remove rebar protruding from the dam and fish ladder. The rebar had been exposed as the concrete dam had eroded from river action and bedload movement and was suspected of injuring upstream migrating fish. At the time the Puyallup Tribe had observed up to 50% of the adult chinook salmon returning to the Buckley trap with injuries that were suspected of occurring from passage over the eroded dam and fish ladder.

On September 5, 2001, the COE submitted data on chinook salmon returns to the Buckley trap to NOAA Fisheries. Also on this day representatives of Tacoma, NOAA Fisheries, and the Puyallup Tribe cut exposed rebar from the face of the dam, which had been ground to a point by bedload movement, but high flows and deep water at the fish ladder made it difficult to successfully access rebar there.

On September 27, 2001, a letter was submitted to NOAA Fisheries by Tacoma which stated that three alternative construction designs would be discussed on October 17, 2001. These alternatives included the proposed open trench design which used a series of cofferdams to divert flows and isolate the project area, open trenching the river in the active channel without the aid of cofferdams, or modifying the existing dam to improve fish passage. Alternatives for bridge crossings and microtunneling or horizontal directional drilling for the placement of the pipe were considered infeasible by Tacoma.

On October 17, 2001, Tacoma held a meeting for agency personnel, including NOAA Fisheries, to discuss issues regarding the project. At this meeting Tacoma presented a number of options to minimize the number of days work would be performed within the river.

On October 29, 2001, Tacoma submitted a revised alternatives analysis to NOAA Fisheries and numerous other agencies involved in permitting the project.

On December 13, 2001, Tacoma informed NOAA Fisheries that they had received conditional permission from King County to conduct the project as proposed, using open trenching to install the pipeline.

On January 8, 2002, NOAA Fisheries received a draft monitoring plan for the project. The plan included monitoring water quality, a brief description of fish handling and passage, wetland and riparian vegetation monitoring, and bank stabilization.

On January 9, 2002, NOAA Fisheries received a comment letter on the project from the

Muckleshoot Tribe, which suggested an approach for mitigating the expected effects that channel regrading would have on threatened chinook salmon.

On January 14, 2002, Tacoma submitted channel cross section data on Boise Creek.

On February 25, 2002, NOAA Fisheries issued an Opinion on this action. Subsequently, the COE issued a permit to Tacoma to construct the project (March 4, 2002).

In December 2002, NOAA Fisheries was informed by Tacoma's consultant that the project was being redesigned to improve fish passage, and that details would be forthcoming. Shortly thereafter Tacoma sent NOAA Fisheries a revised set of plan drawings and a copy of the Joint Aquatic Resources Permit Application for the project that they submitted to the COE.

On January 9 and 10, 2003, representatives of the Services discussed with Tacoma that the consultation with the Federal Energy Commission (FERC) on the Puget Sound Energy (PSE) hydroelectric project may result in increased flows within the bypass reach during construction of their project. It was agreed that the Services would contact FERC to request that reasonable temporary accommodations be made to maintain flows at 350 cubic feet per second (cfs) in order to facilitate replacement of Tacoma's pipeline and removal of the associated dam.

On February 21, 2003, NOAA Fisheries sent the COE and Tacoma a request for additional information on the revised project construction design.

On March 3, 2003, the COE, by way of Tacoma's consultant, R2 Resource Consultants, sent NOAA Fisheries a narrative description of the revised project, which included a draft monitoring plan for Boise Creek, fish passage, and for placing large woody debris (LWD) in the channel. The plans were submitted to fulfill term and condition 1e, and 2f & g of the February 2002 Opinion.

On March 20, 2003, representatives of NOAA Fisheries, Tacoma, the COE, and several other agencies met to discuss the revised construction approach and schedule. Discussion centered around the proposed temporary fish bypass design, the need to coordinate flows and stagger construction windows between Tacoma's project and annual maintenance of the PSE project, the revised configuration of the cofferdams, bank restoration, and contingencies if significant volumes of water leak should into the work site.

On March 25, 2003, representatives of NOAA Fisheries, Tacoma, the Washington Department of Fish and Wildlife (WDFW), and the Muckleshoot Indian Tribe met to discuss the installation of LWD and plans for salvaging fish from the work area.

On April 7, 2003, representatives of NOAA Fisheries, Tacoma, the COE, PSE, the US Geological Survey (USGS), and King County met to discuss removing the gauging station at the pipeline crossing, and staggering the construction of the proposed project with the maintenance of the PSE hydroelectric project and the COE's proposed work at the 9-foot outlet tunnel at Mud

Mountain Dam. As a result of this meeting Tacoma drafted a Flow Coordination Agreement between PSE, Tacoma, and the COE (*draft* April 25, 2003).

On April 21, 2003, NOAA Fisheries received a request from the COE to reinitiate ESA formal consultation and EFH consultation on Tacoma's pipeline and dam removal project. The project design was substantially modified after the February 2002 Opinion was issued, such that new information revealed that the project may affect listed species in a manner or to an extent not previously considered.

On May 13, 2003, representatives of NOAA Fisheries met with PSE, Tacoma, COE, and others to discuss flow coordination and the draft flow agreement. A letter from the Services to the FERC, signed May 27, 2003, asked that the FERC approve the 2003 Flow Coordination Agreement by Tacoma, COE and PSE in order to expedite in-river work in summer 2003 and minimize adverse effects to salmonids.

1.2 Description of the Proposed Action

The action proposed by the COE is the issuance of Nationwide Permit 12 for utility activities required for the construction, maintenance, and repair of utility lines and associated facilities in waters of the US. This permit would be issued to Tacoma pursuant to section 404 of the Clean Water Act and is necessary to authorize the replacement of a section of Pipeline One, which crosses the White River at RM 23.3. Replacement of the pipeline below the calculated maximum scour depth of the river would allow Tacoma to remove the existing grade control dam, thereby eliminating a source of injury, mortality, and delay to fish migrating upstream of the pipeline crossing.

Since NOAA Fisheries completed the February 2002 Opinion on this project several aspects of the construction design have changed substantially. These changes include the way fish are provided passage around the construction area, the number of times cofferdams are installed, the area of impact in the wetted channel and adjacent to the channel, and the coordination of flows within the construction area. Thus the COE reinitiated consultation because the changes in project design may affect listed species in a manner or to an extent not considered in the February 2002 Opinion.

Excavation of the trench and placement of the pipeline itself is largely unchanged from that described in the biological assessment and the February 2002 Opinion. Tacoma proposes to excavate a trench downstream of the existing dam. The trench will span across the full width of the wetted channel, and roughly 300 feet upslope of each bank; making it roughly 800 feet in length. The trench will be excavated about 20 feet below the existing river bed elevation, resulting in the removal of about 6,000 cubic yards of material (R2 Resource Consultants 2000). Tacoma will place the water pipeline in the trench, bedded in and covered by sand. Next, two feet of light loose riprap will cover the sand and pipe. Then the remainder of the trench will be backfilled using native river materials that were removed during excavation of the trench. Finally, the disturbed channel bed will be smoothed to a gradual surface to facilitate fish passage and minimize the potential of split flow paths or scour holes to develop. The top 18 inches will be covered with of a mixture of gravel suitable for chinook salmon spawning (maximum size 102 mm, minimum size 12.5 mm, D_{50} approximately 51 mm).

Site preparation is scheduled to begin on June 1, 2003, and includes clearing for temporary spoils storage areas, and construction of a temporary access road on the north. As a result of the revised cofferdam configuration, however, the new project design increases cleared areas to 4.5 acres (2.1 acres on the north bank, and 2.4 acres on the south bank) from the 1.5 acres considered in the previous Opinion. Wetland impacts on the north bank are also expected to increase with the revised construction approach. Erosion and sediment control measures for the additional disturbed area remains the same as the original proposal.

Instream construction would begin August 15 and would be complete by September 30. The revised plan involves roughly six weeks of instream construction activities, which amounts to five weeks less than originally proposed by Tacoma. The change in cofferdam design and use of bioengineered bank stabilization techniques facilitates a condensed work schedule.

1.2.3 Installation of the Cofferdams

The revised construction approach includes the installation of two cofferdams across the entire width of the channel, which will remain in place for the duration of instream construction activities. This revision reduces the number of times cofferdams are moved and reinstalled, and the number of times fish salvage is necessary, but increases the total area of river dewatered.

The cofferdams will consist of large polypropylene sacks filled with clean spawning gravel. The sacks will be installed one at a time using a crane and a loader or excavator, until the full width of the channel is crossed. Concurrent with the installation of the cofferdam a crew will be attempting to remove fish from the construction area, which is described in greater detail in the next section and in the Revised Construction Approach and Contingency and Monitoring Plan (R2 Resource Consultants 2003). When the sacks are installed a polyurethane apron will be draped over the upstream side. The apron will extend about 30 feet upstream and will be weighted down with smaller bags of clean gravel.

The purpose of the apron is to help reduce flow under the cofferdam and into the construction area. According to R2 Resource Consultants (2000), artesian flows may lead to problems during construction by undermining the integrity of the trench. To reduce flows through the construction site and relieve artesian pressure, four well points will be drilled, two on each end of the dam. The wells will be 30 inches in diameter and 10 feet below the pipe invert. The bore holes will be encased in perforated steel, backfilled with sand around the casing, and sealed with bentonite (R2 Resource Consultants 2000). While these measures may alleviate the subsurface flow into the work area, Tacoma acknowledges that hydraulic conductivity may be high so they are prepared to work underwater if necessary (G. George, Tacoma, pers. comm., March 20, 2003).

Cofferdam installation is expected to take about two days. The total area encompassed by the cofferdams is approximately 50,000 square feet of the mainstem White River. When construction of the project is complete, the gravel filled sacks that compose the cofferdam will be emptied into the channel as flow is returned to the dewatered reach.

1.2.4 Fish Salvage

Isolating and dewatering of the mainstem White River would likely strand fish within the work area. To minimize take of chinook salmon and harm to other salmonids, Tacoma proposes to collect fish from between the cofferdams before the pipeline trench is excavated. At least 16 people (four teams of four) will collect fish from the work area. Each team will be supervised by a fish biologist experienced with collecting and identifying salmonids. Approximately one week before in river construction begins, team leaders will meet on site to rehearse collection procedures, identify transport and release routes, and discuss whether adjustments to the collection plan are necessary.

Using a beach seine Tacoma proposes to make at least two sweeps of the construction reach before dewatering begins. The grade control dam effectively splits the work area into two sections, and the first sweep would occur upstream of the dam. Fish encircled by the seine in the upstream reach would be captured and released upstream of the work area. The crew will then stretch the seine across the channel downstream of the fish ladder and grade control dam, attempting to herd fish downstream of the construction area. A temporary block net will then be installed downstream of the work area to prevent fish from moving up into the work area.

After seining is complete Tacoma will block flow through the fish ladder in an attempt to maintain a small ponded area just upstream of the ladder while the crew concentrates on collecting fish from below the dam. As flows drop the salvage area will be divided into four sections with each team concentrating on collecting fish from within their quadrant. Tacoma proposes to have the crews concentrate on collecting adult salmonids first, then juveniles. Other fish species and amphibians would be salvaged after the salmonids are removed, if possible.

Fish will be temporarily stored in buckets or other large containers filled with river water. At least eight 54-quart coolers, four 33-gallon containers with lids, sixteen 5-gallon buckets and numerous aerators will be available on site to use for temporary holding. Tacoma intends to load adult salmonids into a fish tote on the back of a pickup truck located on the north bank for easy transport upstream of the construction site. Adult salmonids will be returned to the river either by hand or a plastic chute that would drain into a deep low velocity area. Juvenile fish that are collected will be returned to the nearest low velocity area outside of the construction zone.

Two large pools are located within the construction area where large numbers of fish may congregate. If the pool along the north bank is isolated from mainstem flows, then Tacoma proposes to seine this pool the day before other fish salvage efforts begin. At least two 2-inch submersible pumps with 100-foot hoses will be on site as it may be necessary to pump water out of the pools to facilitate fish removal. All pump intakes will be screened to prevent entrainment of small fish. The other large pool in the construction area is the plunge pool formed by scour at the fish ladder. This is where the majority of fish are expected to be found. Tacoma proposes to seine this pool no less than one hour after all flow through the work area has been cut-off.

The number, species, size, and condition of all adult salmonids collected from the work area will be recorded. To the extent possible, the number, species, size, and condition of all juvenile salmonids collected will also be recorded. If data collection interferes with the rapid return of juvenile fish to the river, then species' numbers will be estimated according to each collection area. Tacoma intends to photo document the fish collection efforts and submit a written report describing relative success of the fish collection within 60-days after construction is complete.

A similar, albeit smaller scale fish collection effort will be conducted when the temporary bypass channel is dewatered and flows are returned to the mainstem White River. For this effort, the bypass channel will be divided into five 100-foot long sectors with at least five persons, supervised by a qualified fish biologist, collecting fish. Additional details regarding fish collection are found in the Revised Construction Approach and Contingency and Monitoring Plan (R2 Resource Consultants 2003).

1.2.5 Fish Passage

Since construction of the project will occur when fish are expected to migrate through the action area, Tacoma proposes to provide fish passage around the site. The original project design proposed using a Denil fish ladder installed within the mainstem channel at the grade control dam. However, after the February 2002 Opinion was complete, Tacoma began investigating other methods of providing fish passage around the construction site to improve passage performance and reduce risk to migrants. As a result, Tacoma revised the approach to include the construction of a temporary bypass channel on the south bank. The bypass channel is about 450 feet long and 35 feet wide, with an overall gradient of 1.6 percent, and is designed to function at 350 cfs, the anticipated regulated flow of the mainstem White River below the PSE project. The sinuous planform of the bypass channel is governed by construction sequencing and the elevations of the existing and new pipelines. The bypass channel will be lined with rock and hypalon, a synthetic rubber, to prevent leakage of water between the bypass channel and the pipeline trench. Tacoma expects that the average water velocity in the bypass channel will be about 7 feet per second (fps) and that the average water depth would be about 2.5 feet. Clusters of boulders will be placed at approximately 10-foot intervals, and shallow depressions would be excavated behind each boulder cluster. The purpose of these roughness elements is to provide pockets of lower velocity water for fish to rest in as they migrate through the channel.

The bypass channel would be excavated before the cofferdam is installed and the mainstem White River is blocked to migration. A plug of material would be maintained at the upstream end of the bypass until instream construction begins. With the initiation of installation of the cofferdam, the plug would be removed and flow would be directed into the temporary bypass channel. After the pipeline is covered and the grade control dam is removed, flow will be returned to the White River and the bypass channel will be dewatered. About 4 hours before flow is diverted into the mainstem, a block net will be installed across the downstream end of the bypass channel to prevent additional fish from moving into the channel. During dewatering of the bypass channel a crew of five will be collecting any fish that become stranded and will transport them to a safe release point as discussed previously (section 1.2.4 of this Opinion). Due to the velocity of the water within the bypass channel, Tacoma does not expect significant usage by juvenile salmonids.

1.2.6 Bank Stabilization and Large Woody Debris

The revised project design would disturb about 450 feet of stream bank on each side of the channel, roughly 250 feet more bank than originally proposed. The banks would be reconstructed using bioengineered techniques, which includes the use of geotextile fabric, native plants, and large native river rock excavated from the trench.

The revised proposal also requires the removal of the existing LWD jam below the grade control dam. Tacoma proposes to retain and reuse sound logs removed from the jam and install five LWD jams to mitigate the loss of this jam. This mitigation will also partially offset the loss of riparian forest and pool habitat, which has been provided by the grade control dam and will be altered by the regrading of the channel. The jams should also act as additional erosional protection to the disturbed portions of the north and south banks.

The jams will consist of three key-sized pieces of LWD and three smaller LWD pieces, termed rack members, wedged between key pieces. Based upon Fox *et al.* (2003) a key piece size for the White River has a volume of at least 371 cubic feet and has an attached rootwad. Tacoma proposes to use rack members that are at least 6.6 feet long, with a minimum diameter of 4 inches. Wood used in the jams will consist of native evergreen trees such as cedar, fir, or hemlock, and will not be cabled or anchored.

Four of the proposed LWD jams will be placed within the construction area following installation of the pipeline and removal of the dam. Three of the four jams would be placed along the north bank of the White River, and the fourth jam would be placed along the south bank. The remaining LWD jam will be placed downstream of the Highway 410 bridge at a location accessible by existing roads. The exact location of this jam will be determined by representatives of the Services, COE, WDFW, Muckleshoot Indian Tribe, and King County. Final location for each jam will be directed by an engineer and a fish biologist. All jams would be located in areas that remain wetted during low flows.

1.2.7 Interrelated and Interdependent Actions

This revised project contains an interrelated action and two interdependent actions. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are defined as those that have no independent utility apart from the action under consideration (51 CFR 402.02). First, the COE determined that an interrelated action may be necessary in Boise Creek (RM 23.9), should the project degrade existing fish access (Smith and Terzi 2000). The need or extent of the interrelated action for Boise Creek cannot be determined presently; however, it shall be evaluated through monitoring outlined in the biological assessment and supporting documents. Any work or action necessary in response to monitoring will be conducted either through an amendment or reinitiation of this consultation.

The interdependent actions are the coordination of activities with the COE and PSE that would affect flows within the construction area. Successful completion of Tacoma's project requires fairly consistent low flows. However, when PSE conducts annual maintenance on their hydroelectric project at RM 24.3 water diversion stops and the construction reach receives full river flows, which can be in excess of 1,000 cfs during August. Typically, PSE conducts annual maintenance of their diversion canals during August, which is the same month proposed for construction of Tacoma's project. Unregulated flows, or extreme flow variation that occurs with PSE's maintenance activities would prohibit the successful removal of Tacoma's dam because it would render the design of the temporary construction bypass inoperable, impeding passage of threatened Puget Sound chinook salmon upstream of the project site, and it would subject contractors to high flow conditions that would increase work area instability. As a result, PSE has agreed to begin their annual maintenance activities and FERC ordered headgate repairs on July 15, two weeks earlier than usual Since construction of the cofferdam at the PSE headgate inlet requires flows typical of average conditions in early August (i.e., approximately 900 cfs) in the White River and the activity would be moved to July, the COE has agreed to provide temporary storage at Mud Mountain Dam to maintain flows at or below 900 cfs during the last two weeks of July to facilitate PSE construction activities at this earlier time. These two actions, the change in timing for PSE's maintenance outage, and the COE's storage of flows behind Mud Mountain Dam have no independent utility and would not occur but for Tacoma's project.

Upon completion of their maintenance activities and headgate repair, PSE shall resume diverting White River flows according to the terms of their operating agreements. PSE intends to maintain instream flows as close to 350 cfs as possible to ensure consistent flows suitable for construction of Tacoma's proposed project between August 15 and September 30. In the event of high flows, the COE would capture inflows greater than 2,300 cfs at Mud Mountain Dam because PSE is limited to a continuous diversion of 2000 cfs and completion of Tacoma's project requires flows as close to 350 cfs as possible. It is the intent of the COE to release any storage as soon as possible (subject to regulated release rates) and prior to Tacoma initiating instream construction. The terms of this arrangement are outlined in the Flow Coordination Agreement (2003), which includes protocol for emergency management should unexpectedly high inflows occur or other unforeseen emergency circumstances arise.

1.2.8 Site Restoration and Monitoring

The proposed project includes monitoring of biological, physical, and chemical changes resulting from construction activities and longer term responses to removing the grade control structure. To restore upland areas, Tacoma proposes to scarify and regrade the slopes, and add additional topsoil to promote plant growth. Exposed upland areas and the disturbed portion of the wetland on the north bank will be hydroseeded or planted with native trees and shrubs. Tacoma proposes to monitor these plants for 5 years following construction. Other aspects of proposed monitoring as they relate to fish passage and changes in channel condition are briefly described below. Additional details of the proposed monitoring approach are found in the biological assessment (R2 Resource Consultants 2000) and the monitoring and contingency plan (R2 Resource Consultants 2003).

1.2.8.1 Fish Passage

During construction activities Tacoma proposes daily monitoring of fish passage around the work area through direct observation of fish behavior within and downstream of the bypass reach. A staff gauge and continuously recording pressure transducer will be installed within the bypass channel to measure the instantaneous discharge through the channel. Tacoma intends to work with PSE and USGS to calibrate flows in the bypass channel with the USGS White River gage near Buckley and the PSE project. These data would be used to estimate velocity within the bypass channel on a daily basis. Pools or other potential holding areas within 500 feet of the downstream side of the construction area will be surveyed for adult fish one week before construction in an attempt to establish a baseline estimate of the number of adults holding when passage is not restricted by construction activities. Since the turbid condition of the White River can interfere with visual observations, Tacoma may use a short seine to confirm fish presence and estimate abundance. When construction begins, these same pools will be checked daily to determine if fish are concentrating in these areas.

Fish returns to the Buckley and White River hatcheries will also be tracked daily during construction activities. Tacoma proposes to use data from the period two weeks before construction begins to confirm with the Services, WDFW, and the Muckleshoot and Puyallup Indian Tribes, what values of change would trigger contingency measures should significant reductions be noted at the traps. Presently, Tacoma proposes that unless trap data collected immediately prior to construction suggest otherwise, "significant" changes would be zero returns of anadromous salmonids over a three day period. If there are no returns over a three day period, then Tacoma would contact the Services and WDFW immediately, and will attempt to reconfigure the bypass channel to improve physical conditions that ameliorate the problem. As a final resort, if passage is not improved by changing the configuration of the channel, then Tacoma proposes to net adult fish downstream of the bypass channel and release them upstream of the construction area for the duration of instream construction activities.

Also following completion of instream construction, water depth and velocity will be measured daily for seven days. If the construction area exhibits critical shallow depths that could impair passage, then Tacoma proposes to contact the Services and others before they attempt to excavate a passable channel through the construction area using hand tools or heavy equipment stationed outside of the wetted channel. If such an effort is necessary, then Tacoma would begin another seven day monitoring period. When physical and biological habitat criteria are met and fish returns to the upstream traps and Boise Creek are within the expected range, then post-construction monitoring will be reduced to weekly. Additional monitoring will occur within

48 hours of freshets that increase baseflow in the mainstem by more than 30%. Otherwise, weekly surveys will continue until November 30 or the onset of fall rains that generally maintain stream flows above the regulated minimum flows. See section 1.2.8.3 for more about Boise Creek.

1.2.8.2 Water Quality

Turbid water from the construction site will be pumped to a series of mobile settling basins. The perimeter of the construction area, including stockpile locations, staging areas and the Baker tanks will be surrounded with a silt fence to reduce runoff from these areas. Such controls would be checked daily and repaired as necessary. In addition, Tacoma will measure the water quality (turbidity) of water at four locations: in the wells, leaving the Baker tanks, and 500 feet upstream and downstream of the construction site on a daily basis. If turbidity at the Baker tank outfall exceeds background levels in the White River by more than five Nephelometric Tubidity Unit (NTUs) or 10% of the upstream value, the contractor will be notified within 24 hours and construction will be halted, or additional erosion control or water treatment measures will be implemented. If turbidity in the any of the four wells exceeds that of the White River upstream of the project site, then water from the wells will be routed to the Baker tanks for settling before it is returned to the White River (R2 Resource Consultants 2000). Water quality monitoring will also occur within Boise Creek should rainfall exceed one-inch in a 24-hour period during construction. Tacoma intends to respond as described above, if turbidity increases by more than 5 NTUs or 10% of the upstream values.

1.2.8.3 Boise Creek

NOAA Fisheries' 2002 Opinion on this project required that the COE ensure that Tacoma prepared a plan for monitoring short and long-term changes in channel profile and fish passage to Boise Creek and the White River (term and condition 2g). In response to this, Tacoma submitted a plan for monitoring Boise Creek (R2 Resource Consultants 2003). Long-term monitoring intends to track the upstream progression of headcutting in the White River and the configuration of the Boise Creek channel. As part of this monitoring, Tacoma committed to provide $100,000 over a 25-year period to monitor conditions in the White River upstream and downstream of the construction site. This commitment will be outlined in a separate agreement between King County and Tacoma.

Tacoma intends to document the migration of the mainstem headcut as it proceeds upriver past Boise Creek. With respect to Boise Creek, the White River channel will be considered to have stabilized when it has headcut 100 feet or more past the confluence with Boise Creek and at least one season of fall-winter high flows has occurred. Initial surveys would occur immediately following construction and before the onset of fall rains. Repeat surveys of the White River thalweg profile will be conducted annually for three years and thereafter following peak flows of at least 8,000 cfs until the headcut has reached at least 100 feet upstream of Boise Creek. If no headcutting is observed following at least two flow events of 15,000 cfs, then Tacoma would consider the White River to be stable.

Repeat surveys of five cross sections of Boise Creek would be conducted annually for three years after the headcut in the White River has passed the confluence. After that Tacoma proposes to survey Boise Creek after floods of more than 600 cfs for a period of up to 25 years. In addition, Wolman pebble counts of bed substrate, habitat surveys, and an inventory of LWD would be conducted on the same schedule. If monitoring reveals the formation of a headcut in Boise Creek, then Boise Creek would be determined to have reestablished equilibrium if the headcut has migrated up to the Mud Mountain Road bridge, or the headcut remains stationary through at least two flow events in excess of 800 cfs.

Once the Boise Creek channel is determined to be stable, Tacoma intends to contact the Services to initiate consultation on any necessary final actions to maintain fish passage in Boise Creek over the long-term. If the gradient of Boise Creek increases more than five percent over a 50-foot length at any time, fish passage will be considered potentially impaired. If that condition is noted, Tacoma would contact the Services to develop a plan to provide fish passage until Boise Creek reestablishes equilibrium. Additionally, monitoring also includes visual observations of fish behavior. If fish are observed to be struggling with passage in Boise Creek then Tacoma intends to contact the Services and develop a plan to determine why passage is impaired, and what actions if any would be necessary.

1.3 Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this project extends from RM 31.5 to the Puyallup River estuary at Commencement Bay. The extent of the action area is defined by the effects of flow modifications that potentially would occur from the interdependent actions. As a result of Tacoma's project, the COE may temporarily regulate outflows at Mud Mountain Dam to accommodate a change in timing of PSE's annual maintenance and headgate repair, and to maintain flows of 350 cfs in the bypass reach throughout the construction of Tacoma's project. Under an extreme storm event scenario, using the highest recorded flow of 4,530 cfs during the construction period, the COE estimates it could be necessary to store about 9,000 acre-feet of water at Mud Mountain Dam in order to keep from washing out Tacoma's construction site. Based on this volume of water the estimated length of the pool would extend upstream about 10,000 feet from the dam.

Project effects extend downstream to the estuary because the project will affect the volume and timing of water, sediment, and nutrient delivery to the estuary. NOAA Fisheries has issued a preliminary draft Opinion on the PSE project that delineates the downstream extent of the action area as the Puyallup River estuary because the volume of water, sediment and nutrient delivery is affected by energy generation activities from this project (NOAA Fisheries draft Opinion 2002). As part of Tacoma's project, flow coordination with PSE is an interdependent action and would result in the typical flow regime changes expected from PSE maintenance activities occurring two weeks earlier than usual (July 15 rather than August 1). Therefore, the action area for Tacoma's project incorporates the downstream extent of the PSE action area because it affects the timing of PSE's effects on the estuary. The vast majority of this action area is confined to the river with the exception of Tacoma's construction area. The action area extends upslope of the White River at the construction site (2.4 acres on the south bank and 2.1 acres on the north bank), and includes the lower 500 feet of Boise Creek (RM 23.9). This definition of the action area is based on the biotic, physical, and chemical effects of the action on the environment.

2.0 ENDANGERED SPECIES ACT

2.1 Biological Opinion

The ESA of 1973 (16 USC 1531-1544), as amended, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the Services to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitats.

This document is a product of an interagency consultation pursuant to section 7(a)(2) of the ESA and its implementing regulations found at 50 CFR Part 402. The objective of this consultation is to determine whether the COE's issuance of a permit to Tacoma for the replacement of their pipeline crossing by open trenching the White River, and the subsequent removal of the grade control dam is likely to jeopardize the continued existence of Puget Sound chinook salmon. Since critical habitat for this ESU was vacated pursuant to a consent decree (National Association of Homebuilders *et al.* v. Evans, Civil Action No. 00-2799 [CKK] [D.D.C., April 30, 2002]), this document does not include a critical habitat analysis.

2.1.1 Status of the Species

NOAA Fisheries completed a status review of chinook salmon from Washington, Idaho, Oregon, and California in 1998, which identified fifteen distinct species (ESUs) of chinook salmon in the region (Myers *et al.* 1998). After assessing information concerning chinook salmon abundance, distribution, population trends, risks, and protection efforts, NOAA Fisheries determined that chinook salmon in the Puget Sound ESU are at risk of becoming endangered in the foreseeable future. Subsequently, NOAA Fisheries listed Puget Sound chinook salmon as threatened on March 24, 1999 (March 1999, 64 FR 14308). This listing extends to all naturally spawning chinook salmon populations residing below natural barriers (e.g., long-standing, natural waterfalls) in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula, inclusive.

The Puget Sound ESU is a complex of many individual populations of naturally spawning chinook salmon, and 36 hatchery populations (March 1999, 64 FR 14308). Recently, the Puget Sound Technical Recovery Team (PSTRT), an independent scientific body convened by NOAA Fisheries to develop technical delisting criteria and guidance for salmon delisting in Puget Sound, identified 22 geographically distinct populations of chinook salmon in the Puget Sound

ESU including one in the White River (PSTRT 2001, 2002; BRT 2003). These population designations are preliminary and may be revised based on additional information or findings of the PSTRT. Through the recovery planning process NOAA Fisheries will define how many and which naturally spawning populations of chinook salmon are necessary for the recovery of the ESU as a whole (McElhany *et al.* 2000). At this time only five hatchery stocks are considered essential to the recovery of Puget Sound chinook salmon. The listed hatchery stocks are: Kendall Creek (spring run), North Fork Stillaguamish River (summer run), White River (spring run), Dungeness River (spring run), and Elwha River (fall run) (March 1999, 64 FR 14308).

In most streams within Puget Sound, both short- and long-term trends in chinook salmon abundance are declining. Overall abundance of chinook salmon in this ESU has declined substantially from historical levels and many populations are small enough that genetic and demographic risks are high. An updated assessment of the status of the ESU indicates that about half of the populations are declining and half are increasing in abundance based on long-term trends in abundance and median population growth rates (BRT 2003). The conclusion of the BRT after the updated assessment was that this ESU remains likely to become endangered. The BRT were particularly concerned that the concentration of the majority of natural production occurs in just two basins, hatchery production has been very high, and widespread losses of estuarine and lower floodplain habitat diversity have occurred within the ESU (BRT 2003).

Genetic diversity and fitness of naturally spawning populations may be severely reduced through the widespread influence of hatchery populations. In 1993, WDF *et al.* classified 11 out of 29 stocks in this as being sustained, in part, through artificial propagation. According to Myers et al. (1998) nearly 2 billion fish have been released into Puget Sound tributaries since the 1950s, many of which consisted of interbasin transfers of Green River hatchery fish (Marshall *et al.* 1995).

Harvest impacts on Puget Sound chinook salmon stocks have been quite high in the past. Total exploitation rates averaged 75% based on the earliest data available (BRT 2003). Fifteen of the 22 independent populations had average exploitation rates greater than 75%, while exploitation of four populations was greater than 90%. Recent data indicates that the average exploitation rate for the ESU is 44% (BRT 2003).

Migratory blockages and degradation of freshwater habitat have contributed to reduced abundances in this ESU. Widespread agriculture, urbanization, and forest harvest have significantly altered the complexity of freshwater and estuarine habitats used by chinook salmon. Diking, dredging, and other forms of hydromodification have diminished the amount of side-channel and slough habitat available for rearing and spawning. Spring- and summer-run chinook salmon populations throughout the Puget Sound ESU have been particularly affected. These life histories have exhibited widespread declines throughout the ESU and some runs are considered extinct (Nehlsen *et al.* 1991; March 1999, 64 FR 14308, PSTRT 2002). These losses represent a significant reduction in the life history diversity of this ESU (Myers *et al.* 1998; March 1999, 64 FR 14308).

2.1.2 Evaluating the Proposed Action

The standards for determining jeopardy are set forth in 50 CFR 402 (the interagency consultation regulations). In conducting this analysis, NOAA Fisheries first considers (1) the biological requirements of the listed species, and then (2) evaluates the relevance of the environmental baseline to the species' current status. Subsequently, NOAA Fisheries determines if after the proposed action is complete the species would be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of injury and mortality attributed to: (1) the collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any cumulative effects within the action area. This evaluation must take into account measures for survival and recovery specific to the listed salmon's life stages that occur beyond the action area. If the action is found likely to jeopardize, then NOAA Fisheries would identify reasonable and prudent alternatives for the action.

2.1.2.1 Biological Requirements

The first step in the ESA section 7(a)(2) analysis is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list Puget Sound chinook salmon for ESA protection and also considers new data available that is relevant to the determination.

Relevant biological requirements are those conditions necessary for the Puget Sound chinook salmon ESU to survive and recover to naturally reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment (McElhany et al. 2000). The biological requirements of chinook salmon include food, flowing water (quantity), high quality water (cool, free of pollutants, high dissolved oxygen concentrations, low sediment content), abundant clean spawning substrates, and unimpeded migratory access to and from spawning and rearing areas (adapted from Spence *et al.* 1996). The biological requirements of Puget Sound chinook that are likely to be affected by the project include water quality, water quantity, water velocity, cover/shelter, food, spawning substrates, riparian vegetation, and access.

2.1.2.2 Status of the Species in the Action Area

Recently, the PSTRT delineated one independent population of chinook salmon within the White River (2001). Both hatchery and naturally spawning White River fish are protected under the ESA because this hatchery stock is one of the five hatchery stocks essential to the recovery of the Puget Sound ESU. The population is believed to contain both spring and summer/fall runs. For the most part, the primary means of discerning between the two runs has been according to the timing of their arrival at the COE's Buckley trap (RM 24.3). Those fish that arrived before

August 15 were classified as spring chinook and those that arrived later were considered part of the summer/fall run. Recent DNA analyses conducted by WDFW, however, suggests that the spring and fall stocks are genetically distinct stocks (Shaklee and Young 2002). The spring run is also genetically unique and comprises the last existing spring chinook salmon stock in South Puget Sound.

Hatchery influence on this stock has been extensive. In the early 1970s, an artificial propagation program was established for White River spring chinook salmon because returns were critically low (WDFW *et al.* 1996). The artificial propagation program was initially started to restore the south Puget Sound fishery, and by the late 1970s, NOAA Fisheries was working cooperatively with WDFW and the Muckleshoot and Puyallup Indian Tribes to avoid extinction of the stock (WDFW *et al.* 1996). It would be difficult, as a result of the changes the population has undergone, to know how the historic genetic make up of the chinook may compare to what constitutes this run today. Since the White River historically flowed through the Green and Duwamish River and now flows through the Puyallup, the distinctness of the fall run may be influenced by Puyallup River, Green River and Green River-origin hatchery fish, and late White River fish or some combination of these (J.Myers, pers. comm., April 28, 2003). It is not clear, however, that White River chinook salmon possess sufficient remaining resilience to survive and recover in the absence of augmentation through artificial production (T. Tynan, pers. comm. w/S. Fransen, NOAA 2002).

Counts of adult chinook salmon in the White River dropped precipitously from the earliest counts at the Buckley trap to a critical low in the 1970s (WDFW *et al.* 1996). The Buckley trapping effort provides the longest data set available on White River chinook salmon (Figure 2-1). Trap and haul operations began in 1940 and counts of fish returning to the trap began in 1941. Chinook salmon returning to the trap averaged 2,800 annually, ranging from 1,200 to almost 5,500 in the first decade of operation[1] (WDFW *et al.* 1996; Ladley *et al.* 1999). Counts declined steadily until about 50 chinook salmon returned in 1977, and in 1986 only eight fish (six adults and two jacks) were passed above the dam (COE, Seattle District, *unpubl. data*; WDFW *et al.* 1996; Ladley *et al.* 1999).

In 1991, Nehlsen *et al.* identified the White River spring run as having a moderate risk of extinction and in 1999, NOAA Fisheries listed the White River spring-run as one of only five hatchery populations essential for the recovery of the Puget Sound ESU (March 1999, 64 FR 14308). The decline of the stock is attributed to the additive, cumulative, and synergistic effects of intense human activities (Ladley *et al.* 1999). Harvest and habitat constraints, specifically flow regime, sedimentation, streambed instability, estuarine loss, reduced LWD volumes, and passage problems associated with dams affect White River chinook salmon, threatening the long-term viability of the population (Bishop and Morgan 1996). These and other threats to White River chinook salmon are described below, under *The Environmental Baseline.*

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[1]WDFW *et al.* (1996) suggested that these early returns were already depressed as a result of “unmitigated” hydropower operations since 1911.

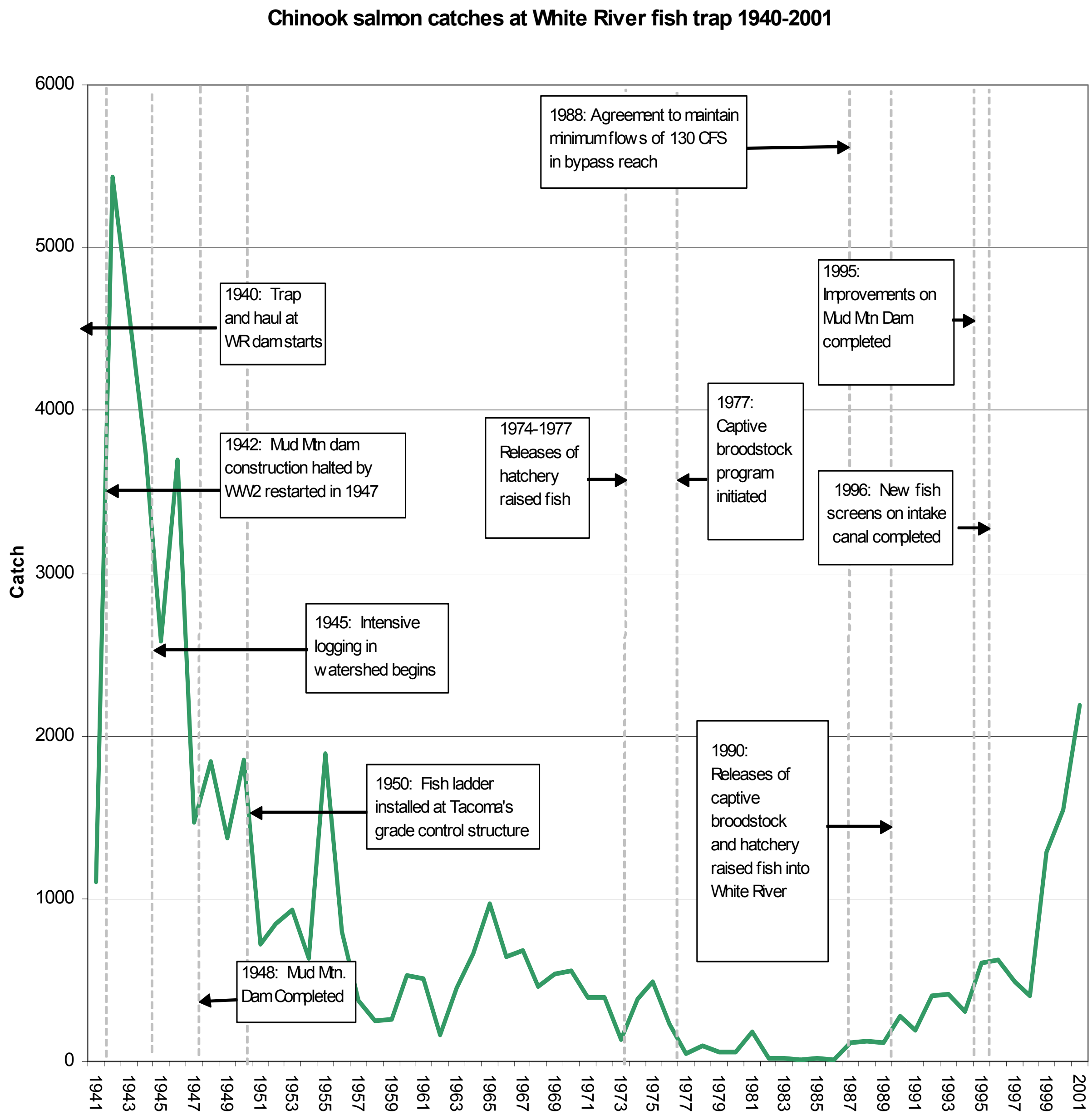

Figure 2-1. Chinook salmon captured at the Buckley trap from 1940-2001.

Data suggest that the White River stock is responding to recent management efforts to increase returns, which have included reduced harvest, modifications to Mud Mountain Dam, the installation of screens at the PSE diversion, increased flows in the bypass reach, and the release of over 2,000,000 hatchery chinook between 1992 and 1999. While the PSTRT (2002) has not yet issued population viability planning ranges for the White River population. However, in 1996, WDFW *et al.* established an interim recovery goal of passing 1,000 natural spawners above Mud Mountain Dam for "three out of the four consecutive years with the normal level of incidental sport, commercial and tribal harvest." The number of spawners passed above Mud Mountain Dam has exceeded 1,000 three times in recent years (1999, 2000, and 2001), while the five-year geometric mean of recent natural spawners is 735 chinook salmon (BRT 2003).

The vast majority of adult chinook salmon enter the White River between June and October. However, between 1942 and 1950 chinook salmon were typically encountered at the Buckley trap from May through August, with peak returns in June (WDFW *et al.* 1996; Ladley *et al.* 1999). Currently, chinook salmon exhibit a bimodal return to the Buckley trap (See Figure 2-2). The peak number of chinook salmon returning to the Buckley trap, according to average weekly returns between 1986 and 2000, occurs first in July, and then again at the end of September (data are for total chinook catch at Buckley, which includes hatchery fish) (COE, Seattle District, *unpubl. data*). For the 10 year period considered the second peak (September) was higher, but more recently (1996 to 2000) returns have been higher during July (COE, Seattle District, *unpubl. data*).

According to chinook salmon returns to Buckley from 1990 to 2002, it appears that about 45% of the White River chinook salmon population will migrate through the action area during the proposed 6 week construction period. In general, White River chinook salmon spend about 16 to 18 weeks in fresh water before spawning. During a recent radio-telemetry study, the Puyallup Tribal Fisheries Division (PTFD) tagged a total of 147 chinook and 125 chinook in 1996 and 1997 in the lower Puyallup River, respectively. The study revealed that once chinook salmon entered the lower Puyallup River they took an average of about two weeks before entering the White River, and another 40 days to pass through the lower White River to the Buckley trap (Ladley *et al.* 1999). This suggests that when the construction area is dewatered many fish that are salvaged may have already been in freshwater for 8 weeks.

During their upstream migration chinook salmon will generally hold in deep pool habitat, particularly during extended periods before spawning. Deep pool habitat provides important resting areas to migrants and can also provide thermal relief from warm water in the mainstem White River. Ladley *et al.* (1999), however, did not observe chinook salmon holding exclusively in pools during their telemetry study, which may be, in part, a result of poor pool quality (insufficient pool depths and cover) in the White River.

The majority of White River chinook salmon spawning occurs in four major non-glacial tributaries in the upper watershed: Boise Creek (RM 23.9), Clearwater River (RM 35.3), Greenwater River (RM 45.8), and Huckleberry Creek (RM 53.1) (Ladley *et al.* 1999; Williams *et al.* 1975). Only one of these streams, Boise Creek, occurs within the action area. Peak spawning in tributaries above the Mud Mountain Dam occurs about mid-September, roughly 8 weeks after peak returns to the Buckley trap (Ladley *et al.* 1999). Boise Creek, which enters the White River about 140 feet upstream of Tacoma's existing pipeline, produces a large portion of the chinook salmon within the White River basin (J. Iverson, PTFD, pers. comm., 2001). Most of the

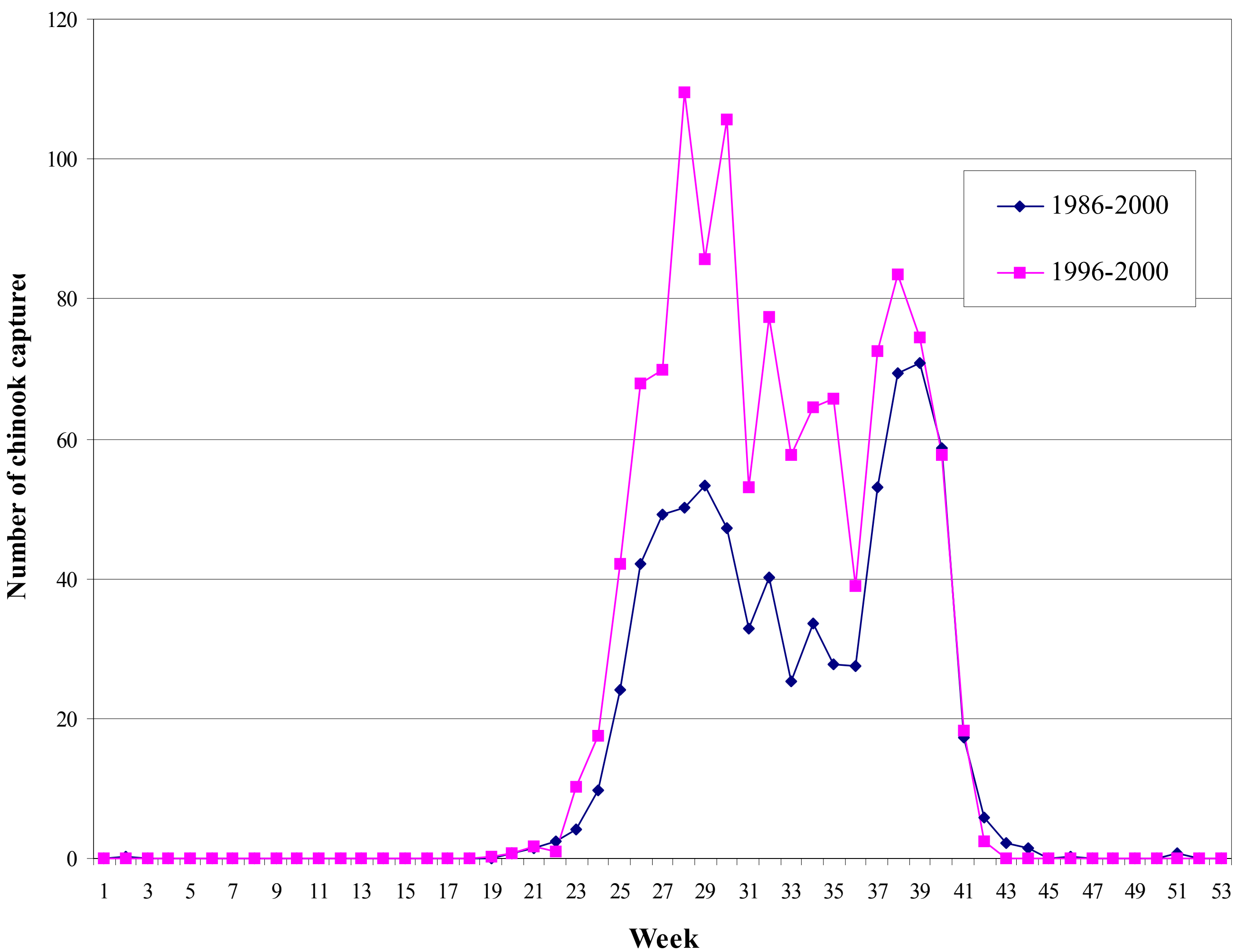

Figure 6 Weekly chinook salmon returns to Buckley

chinook salmon that spawn within Boise Creek are probably not counted at the Buckley trap because Boise Creek enters the White River about one-half mile downstream of the trap. Even so, Ladley *et al.* (1999) observed some telemetered fish that were captured at Buckley fell back to eventually spawn in Boise Creek.

The PTFD has conducted chinook salmon spawning surveys in Boise Creek for a number of years. The average number of chinook salmon returning to spawn in Boise Creek, based upon PTFD spawner surveys for the years 1995 to 2000 (PTFD, *unpubl. data*; R2 Resource Consultants 2000), is about 290 fish. Generally, PTFD divides Boise Creek into two reaches for spawning surveys, the first of which covers RM 0.0 to 2.2 and the second of which covers RM 2.2 to 4.5. A waterfall at RM 4.5 prevents upstream use of the Creek by anadromous fish (Williams *et al.* 1975; PTF *unpubl. report*). According to the PTFD surveys from 1993 to 2001, roughly half of the chinook salmon spawn between RM 0.0 and 2.2 (PTFD, *unpubl. data*), although most of the fish spawn upstream of RM 0.5 Ladley, Email, December 27, 2001). However, some spawning occurs in a small area about RM 0.4, roughly 1,600 feet upstream of the action area for the proposed project.

For the mainstem White River, information on chinook salmon spawning is limited, largely by visibility. Surveys for adult chinook salmon below the PSE project have been conducted annually by the PTFD (unpub. data) since 1995. These surveys typically began at the diversion (RM 24.3) and terminated at the Eighth Street Bridge (RM 7.5). Annual redd counts in this reach for the years 1995 to 2001 have ranged from 0 to 99, with an average of 36 redds for the seven years considered. According to fish surveys conducted by the Muckleshoot Indian Tribe between RM 8.9 and 15.5, the density of chinook salmon spawning is much higher in side channels than in the mainstem (Malcom and Fritz 1999). Of the 80 chinook salmon redds counted by Malcom and Fritz (1999), only 7 redds (nine percent) were recorded within the mainstem White River. Malcom and Fritz (1999) surmised, based on observations during their study and previous observations, that spawning in side channels is a typical behavior for White River chinook salmon. Thus, the actual number of chinook salmon spawning in the action area may be considerably higher than the PTFD data suggests, as these surveys are typically conducted by boat and only infrequently include side channel habitats.

After incubation, fry emerge from the gravel from late winter to early spring. Juvenile chinook salmon may then migrate downstream to rear in low-gradient channels (WDFW *et al.* 1996). The majority (80%) of chinook salmon in the White River rear for short periods (one to three months) in fresh water, outmigrating as subyearlings and the remainder (about 20%) outmigrate as yearlings after rearing in fresh water for about one year (Dunston 1955). Scales collected from adult chinook salmon at the Buckley trap confirm age at outmigration (WDFW *et al.* 1996).

Short periods of freshwater rearing may represent an adaptive response by juvenile chinook salmon to the turbid waters of the White River. Characteristically high suspended sediment loads may affect timing and age of fish at outmigration by limiting rearing densities compared to what would be expected in a rain dominated (clear) river of comparable size (Ptolemy *in* Newcombe and Jensen 1996). In other basins, side channels fed by clear groundwater, and valley-wall runoff provide critical non-turbid (or low turbid) habitat and are extensively used by chinook salmon fry (Murray and Rosenau 1989; Chamberlin *et al.* 1991; Scrivener *et al.* 1994). Studies suggest that even nonnatal clear-water, low gradient tributaries are used by juvenile chinook salmon and that these habitat types provide juveniles an opportunity to maximize their growth and survival through increased feeding success (Murray and Rosenau 1989). Such habitat may be particularly important to those fish that outmigrate as yearlings.

2.1.2.3 Environmental Baseline

The environmental baseline represents the current set of conditions to which the effects of the proposed action are then added. Environmental baseline is defined as "the past and present impacts of all Federal, State, and private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or informal section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process" (50 CFR 402.02).

The life history characteristics (e.g., migration timing) of White River chinook are an expression of genetics and also adaptation to the local glacial environment of the basin. White River chinook salmon have evolved in a basin with frequently shifting braided channels, highly turbid waters, a history of large wildfires and major channel shifts between the Puyallup and Duwamish basins.

The headwaters of the White River, which originate at the terminus of Winthrop, Emmons, and Fyingpan glaciers, are considered pristine where they have been protected since 1899 with the creation of Mt. Rainier National Park. The river drains a watershed of approximately 494 square miles to the confluence with the Puyallup River at about RM 10.4, entering south-central Puget Sound at Commencement Bay. The majority of this basin has undergone pronounced changes since European settlement began in the region, as early as 1850 (Williams *et al.* 1975; Kerwin 1999). Currently, the White River is a tributary of the Puyallup River which empties into Commencement Bay near Tacoma, Washington. Prior to 1906, the flow of the White River split into distributaries near Auburn, Washington, with varying volumes of the river (depending on the abundance and distribution of flood-born logjams) flowing northerly into the Green River (which drains into Elliot Bay near Seattle, Washington) and southwesterly via the Stuck River, and then to the Puyallup River. Flooding and human activities resulted in the entire flow of the White River flowing down the Stuck River channel in 1906. This route was later reinforced with permanent structures to prevent reconnection with the Green River.

The White River flows through a series of glacial deposits and the remains of the Osceola Mudflow, which covers the White River valley to a depth of 25 feet. The geologically recent mudflow of approximately 5,700 years ago characterizes the White River as a "young river." As such, it is still in the process of cutting a channel through the mudflows and is characterized by steep gradients, heavy sediment loads, and in places, a deeply incised channel. Several thousand to well over a million tons of sediment are delivered annually from the upper basin to lower gradient reaches, most of which is transported during winter storm events (WDFW *et al.* 1996; Kerwin 1999). Suspended sediment varies from 1 to 6,200 milligrams per liter with annual loads estimated, during a three year study, as ranging from 440,000 to 1,400,000 tons (Nelson 1979; WDFW *et al.* 1996).). Annual average transport above Mud Mountain Dam is estimated at 500,000 tons per year (Dunne 1986) and turbidity during summer months, July through September, ranges from 100 to 1000 NTU for the basin (Ladley *et al.* 1999). Glacial meltwater is the primary source of turbidity during summer months. Data collected by the Washington Department of Ecology (WDOE) in 1996 indicates turbidity at the Sumner station (RM 4.9) ranged from 2 to 260 NTUs, and generally exceeded 25 NTU during summer months (WDOE 2001). The name “White River” reflects the turbid appearance of the river caused by the high levels of suspended glacial sediments during the summer months.

In general, sediment affects the abundance and quality of spawning gravels, pool riffle ratios, water quality, survival to emergence, the delivery of organic materials, and can potentially affect fish access. Data reflect that most chinook in the White River appear to favor spawning in non-glacial tributaries, but this could be an artifact of how difficult it is to observe fish in the turbid mainstem. A freeze-core analysis of White River substrate below the PSE project concluded that based on visual inspection,” ...it appeared that the amount of fines present in many of the cores could adversely affect incubation of eggs and or emergency of fry. However, the values of indices that were calculated generally did not fall in the range that would predict high mortality rates (Hosey and Associates 1989).” There are several other glacial rivers in the region that also carry high sediment loads, have significant channel instability, and have been significant producers of chinook salmon (e.g., the Nooksack, Skagit, Hoh, and Queets Rivers, and others).

Dams and timber harvest practices have altered the timing and volume of sediment transport in the basin, and LWD recruitment to the action area (WDFW *et al.* 1996). The White River basin outside the National Park has been intensely managed for timber harvest, particularly in the last 50 years. As a result, channel sinuosity is simplified, and pool abundance and quality is reduced (WDFW *et al.* 1996; Kerwin 1999). Active debris cleaning further reduced debris loading in the action area.

In general, LWD tends to collect less frequently in large channels like the White River. However, the log jams in rivers this size would tend to be quite massive. LWD jams are a critical component of chinook salmon habitat through their influence on bed and bank scour, hydraulic complexity, side channel development, pool formation and stability, and bar and island formation (Montgomery *et al.* 1995; Spence *et al.* 1996). LWD jams may also help maintain appropriate thermal gradients by inhibiting the mixing of cool water tributaries with mainstem reaches (Spence *et al.* 1996).

For the action area, and in general within the White River basin, LWD does influence pool formation and frequency, although so do more stable obstructions like large boulders or steep bluffs (R2 Resource Consultants 2000; Tinoco 2002). According to the Muckleshoot Indian Tribe Fisheries Department, half of the pools they observed in their survey were formed by wood (Tinoco 2002).

The average bankfull width of the White River in and near the construction area is about 300 feet (Tinoco 2002). According to Fox (In Press *in* Tinoco 2002) a system the size of the White River should have more than 200 pieces of wood greater than 10 centimeter in diameter and 2 meter in length, and more than four key pieces, defined as having a volume of 10.75 cubic meter, per 100 meters of reach length. Rather, the survey reach averaged ten pieces of wood with less than one key piece per 100 meters (Tannic 2002). According to R2 Resource Consultants (2000) the pool frequency for the construction area is about three pools per mile. R2 Resource Consultants (unpubl. data) surveyed five pools greater than one meter deep below the dam, and six pools upstream of the dam. R2 Resource Consultants (2000) believes that the low pool frequency is not unexpected for a river with a tendency towards braided conditions and little stable LWD. On the other hand, the Muckleshoot Indian Tribe asserts that pool frequency is low as a result of the low LWD loading (Tannic 2002). NOAA Fisheries expects that historic and persistent activities that affect wood recruitment to the action area have in turn degraded the pool frequency and quality.

It appears that pool frequency and quality in Boise Creek is "not properly functioning" as well. Roughly the lower one and one-half miles of Boise Creek was rerouted with the construction of State Route 410 (City of Tacoma 1924 *in* R2 Resource Consultants 2000). These changes are believed to have substantially altered the channel gradient and overall morphology. Formerly Boise Creek joined the White River downstream of its present location and likely exhibited a lower gradient. Early maps suggested that the channel was more sinuous, and likely exhibited a higher pool frequency. According to surveys by R2 Resource Consultants (2000) the lower 500 feet of Boise Creek is essentially straight and it exhibits a plane bed morphology. Channel slope averages 1.7 percent with the lower most 200 feet exhibiting a gradient of 2.5 percent. The bankfull channel width of Boise Creek in the action area ranges from about 25 to 50 feet (R2 Resource Consultants 2000).

From RM 11.3 to RM 23.3, the White River is largely unconfined and is free to meander and migrate in response to flow. Between RM 23.33 and 24.3 two sets of old bridge abutments, Tacoma's dam, and the PSE diversion tend to limit channel migration. The mainstem White River, from its confluence with the Puyallup River to the PSE diversion at Buckley (RM 24.3), has lost about 7.2 percent of its channel length, whereas the lower Puyallup River, from its confluence with the White River to its mouth, has lost about 15% of its channel length since 1894-95 (Kerwin 1999). Since Mud Mountain Dam was constructed active geomorphic surface area and length of side channels in the White River from RM 11.3 to 23.3 have been reduced by 56% and 35%, respectively (MITFD unpub. data; Ecocline 2000).

Mud Mountain Dam was authorized by the Flood Control Act of 1936 and was designed to attenuate flood flows. For nearly 50 years the project attenuated floods greater than 2,000 cfs until pool levels reached the second tunnel. Today, the project has a total outlet capacity of 17,600 cfs (COE 2001).

A little more than five miles downstream of Mud Mountain Dam is PSE's hydroelectric project at Buckley (RM 24.3), which diverts a significant portion of the river's flow from about 21 miles of the mainstem White River. The Buckley water diversion was constructed in 1911 and has drastically reduced flows in a major portion of the action area, the bypass reach. Water is diverted at RM 24.3 and conveyed through a series of canals and settling basins to the Lake Tapps reservoir, then to the Dieringer Powerhouse for power generation, and returned to the White River at RM 3.5. In 1910, PSE was required by a Pierce County Superior Court to maintain a minimum flow of 30 cfs since its completion, although low-flows in the bypass reach have ranged between 0 cfs and 130 cfs (WDFW *et al.* 1996; Kerwin 1999). In 1986 an agreement was adopted between PSE and the Muckleshoot Indian Tribe that the project would maintain a minimum of 130 cfs within the bypass reach (WDFW *et al.* 1996). More recently, an agreement between the resource agencies and PSE (effective July 2001) resulted in minimum flows increasing to 350 cfs in April and May, and 250 cfs from June through October. Flows during November through January remain at 130 cfs, and increase to 200 and 275 cfs in February and March, respectively. Additional flow increases have been proposed in the consultation for the PSE project (NOAA draft Opinion 2002).

Operations of the diversion are restricted by license (the first of which was issued by the Federal Energy Regulatory Commission in 1997) for minimum flows (130 cfs), ramping rates and the timing of scheduled outages (WDFW 2000). These requirements are intended to minimize the impacts of PSE's operations on fish within the basin. For instance, periodically (usually annually) PSE shuts off the diversion for maintenance reasons, at which time the river flows naturally through the bypassed reach. Abrupt changes in river flows have stranded fish in the bypassed reach as power generation turbines are brought on and off-line (WDFW *et al.* 1996). In the fall of 2000, PSE shut down the diversion for maintenance, which resulted in natural flows in the 21 miles of the bypass reach. Prior to the outage, flows in the bypass reach were about 275 cfs and during the outage ranged from 700 to 1,400 cfs (WDFW 2000). When the maintenance activities were complete and flows returned to the diversion, flows in the bypass reach fell sharply stranding fish over 750 fish in the north bank scour hole formed by Tacoma's dam.

On August 9, 2003, juvenile fish were observed dead and trapped from changes in mainstem flows in the bypassed reach. This incidence occurred as a result of the COE reducing flows at PSE's request to allow for the rebuilding of their diversion. The Puyallup and Muckleshoot Indian Tribes counted chinook, coho, and chum salmon among the fish that were killed, along with other species. Tens of thousands to hundreds of thousands of juvenile fish were believed to have been stranded throughout the 21-mile bypass reach when this activity has occurred; a large portion of which were likely chinook salmon fry (G. Sprague, email. April 24, 2003; S. Fransen, pers. comm., April 2003).

In general terms of instream flows, the White River basin is considered "over-appropriated" meaning there is not enough water to support users, maintain instream flows, and support healthy salmon runs (State of Washington 1999). Surface and groundwater withdrawals and an increase in impervious surfaces have significantly affected flows in the White River and its tributaries (WDOE *et al.* 1995; Kerwin 1999). These changes have reduced the quantity and quality of chinook salmon habitat and accessibility, and are believed responsible for altering chinook salmon migration timing (Ladley *et al.* 1999).

Habitat access is also severely hampered by the three run of the river dams located within about 6 miles of each other (Mud Mountain, PSE's Buckley diversion, and Tacoma's concrete slab dam). Therefore, as a result habitat access is considered "not properly functioning." Mud

Mountain Dam and PSE's dam are total barriers to upstream migration (Kerwin 1999). To mitigate for the effect of these dams, a trap is located at PSE's diversion and fish captured there are hauled above Mud Mountain Dam. Tacoma's dam, however, is considered a partial barrier to the upstream migration of chinook salmon, but can be a total barrier to other species. The dam has remained an impediment to adult upstream migration for roughly 80 years, although the effect was likely variable. Recent telemetry studies indicate that mortality and significant delays in the upstream migration of chinook salmon occurs at Tacoma's dam (Ladley *et al.* 1999). The structure is also well-known to poachers, and carcasses are a common site during adult salmon upstream migrations.

Although a fish ladder was incorporated into Tacoma's dam in the 1950s, bedload movement and irregular maintenance of the structure has made adult passage particularly perilous. Over time, coarse sediment particles have pounded the structure and hastened its deterioration. As a result, rebar has become exposed, and the ends have sharpened to points. Fish captured at the Buckley trap have been observed with a number of fresh and bleeding wounds, many of which likely occurred as they passed Tacoma's dam. In 2001, Tacoma and others removed a large amount of the exposed rebar from the structure although some pieces were inaccessible at the time. Unfortunately, many of the pieces left behind were located within the ladder, and likely cause greater damage to fish migrating upstream than many pieces that were removed. Tacoma intended to go back to the structure a second time when flows were lower, so that they could better access the ladder and remove exposed rebar. Flows did not drop sufficiently to provide access to the ladder so no second attempt was made to remove rebar in the ladder. This maintenance activity was the first in more than 10 years, although it likely was the first time that exposed rebar was removed to promote safe fish passage (P. Hickey, pers. comm., 2002). In the past, maintenance was generally limited to extending the downstream apron to repair scour under the structure (P. Hickey, pers. comm., 2002).

Changes in flows in the White River have also reduced the efficiency of the ladder as it was built when low flows were only 30 cfs. Today, low flows exceed 250 cfs and water sheet-flows across the concrete slabs around the sides of ladder providing insufficient depth to facilitate passage (R2 Resource Consultants 2000). Degradation of the channel below the structure has also reduced access to the fish ladder (R2 Resource Consultants 2000).

Instream flows are only one of the water quality standards exceeded within the basin. The White River, listed as impaired under Section 303(d) of the Federal Clean Water Act, is in violation of the following standards within the action area: fecal coliform, mercury, copper, and instream flows (WDOE 2000). Boise Creek is listed as impaired for water temperatures (WDOE 2000). The basin, including the action area, is degraded by both the chemical contamination and high instream temperatures. High temperatures may increase the susceptibility of salmonids to infection, interfere with metabolism, and alter migration timing (Spence *et al.* 1996).

The habitat biological requirements of the Puget Sound ESU are not being met under the environmental baseline. Environmental baseline conditions in the action area would have to improve to meet those biological requirements not presently met. Further degradation or delay in improving these conditions might increase the amount of risk the listed ESU presently faces under the baseline.

2.1.3 Effects of the Proposed Action

NOAA Fisheries may use two approaches for assessing the effect of the proposed action (NMFS 1999). First, NOAA Fisheries may consider the impact in terms of the number of Puget Sound chinook salmon that will be killed or injured during a particular life stage and gauge the effects on the population size and viability. Alternatively, NOAA Fisheries may consider the effect of the proposed action on the freshwater biological requirements of the species, which is generally done in terms of the habitat attributes.

In this analysis, the probable direct and indirect effects of the action on the chinook salmon are identified. The ESA implementing regulations direct NOAA Fisheries to do so "together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR §402.02)." Direct effects include those occurring at the project site and can extend upstream or downstream based on the potential for impairing fish passage, hydraulics, sediment and pollutant discharge, and the extent of riparian habitat modifications. Indirect effects are those effects that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Indirect effects can occur throughout the action area, and are used to help define the extent of the action area. Indirect effects may include changes in land use resulting from the construction of basic infrastructure needs that supports the development of undeveloped areas (WSDOT 2001).

The project has the potential to directly induce changes to the following components of chinook salmon habitat: habitat access, sediment transport, pool frequency and quality, off-channel habitat, LWD and riparian vegetation, streambank condition, and water quality. Although addressed separately, these changes may affect multiple indicators of functional chinook habitat. For example, changes in sediment transport within the action area would likely affect habitat access, water quality, streambank condition, off-channel habitat, and spawning and incubation success. These impacts could also be exacerbated by other adverse effects of the project on water quality, for example. Indirect effects of the project may include latent changes in sediment transport and habitat access.

Development is not contingent upon the proposed project and therefore is not considered an indirect effect of the proposed project. The pipeline is currently used to transmit 113 cfs of water, which is withdrawn from the Green River under Tacoma Water's first diversion water right claim. While the new pipe section will be larger than the existing section, the amount of water withdrawn will not increase as Tacoma has agreed to voluntarily cap their first diversion water right claim at 113 cfs as part of their recent Habitat Conservation Plan with NOAA Fisheries (R2 Resource Consultants 2001a).

In this analysis, the changes resulting from the proposed action are expressed in terms of whether it is likely to restore, maintain, or degrade an functional chinook salmon habitat. By examining the effects of the proposed action on the habitat portion of a species biological requirements, NOAA Fisheries can gauge how the action will affect the population variables that constitute the rest of a species' biological requirements and, finally the effect of the action on the species's current and future health (NMFS 1999).

2.1.3.1 Fish Passage and Habitat Access

The proposed project will likely affect short-term and long-term access in the White River and its tributary, Boise Creek. Short-term effects may range from beneficial to adverse. In the longer-term, the project will improve passage conditions in the White River, removing a source of injury, mortality, and delay to migrating fish. Changes in the elevation of the riverbed could adversely affect access into Boise Creek; however, such effects will be identified through post project monitoring and minimized by responsive actions. Responsive actions to maintain temporary and long-term passage into Boise Creek will depend upon the specific conditions observed, and may include the construction of notched logs, boulder weirs, or the placement of a concrete Denil fish ladder. Necessary mitigative actions would be reviewed by the Services and the COE through reinitiation of this consultation.

2.1.3.1.1 Short-term Effects

Construction activities will take place over 6 weeks during the latter portion of the upstream migration of White River chinook salmon. An estimated 45% of the run may pass the project during construction, which is fewer fish than expected under the original proposal. Nevertheless, 45% represents a significant portion of the chinook salmon population counted at Buckley. NOAA Fisheries expects that the bypass channel will successfully provide fish passage around the site, although some rearranging of the structural elements may be necessary after construction to improve passage conditions, which Tacoma is prepared to do. The temporary bypass channel represent an improvement for passage over existing conditions or the use of a Denil fish ladder as originally proposed because it removes the source of injury, mimics a natural channel with hydraulic complexity, increases channel distance while reducing the slope, and routes fish away from construction activities. However, actual velocities encountered by migrating fish in the temporary channel are difficult to predict particularly with the added roughness elements and velocity is sufficiently high that it could deter some fish from entering the temporary channel, depending upon their size and swimming ability. While adult chinook salmon are expected to pass through successfully, the channel was not designed to accommodate upstream migrating juvenile salmonids. Nevertheless, we expect that this would result in insignificant effects on juvenile chinook salmon in the White River. The vast majority of juvenile chinook salmon would have migrated out of the project area earlier in the year. Although a small portion remain through the winter, most of the construction area does not contain high quality rearing habitat. In the short-term construction activities could deter some juveniles from the immediate area, however, once the cofferdams are removed these fish would be able to move freely through the area (Reid *et al.* 2002).

As a precautionary measure, Tacoma has built several contingencies into the project to ensure that passage problems are found and rectified quickly, and in the instance that chinook salmon are not passing, Tacoma is prepared to collect fish below the construction site through seining. Seining in the White River could be problematic given the large substrate that characterizes this reach of the river. Seines work most efficiently in low-velocity areas of sand and small substrate where contact with the bed is maintained, preventing fewer escapees.

After construction is complete and the dam is removed, passage may also be temporarily impaired as a high gradient riffle will likely result in the project area (R2 Resource Consultants 2000). High flows are expected to redistribute sediments and reduce the gradient of the channel bed. Between the time construction is completed and the sediments are redistributed, passage would probably be impaired. While the project proposes several measures to reduce this potential effect, it should also be noted that the vast majority of White River chinook salmon would have migrated through the action area by this time. Tacoma will smooth the channel bed to a gradual slope before the project is completed, which should reduce the risk that multiple shallow flow paths will develop. Second, the project will be monitored weekly until the onset of high flows. If monitoring reveals passage problems, then Tacoma proposes to inform NOAA Fisheries and other resource managers of the problem, and Tacoma will establish a passable channel through the area using hand tools.

2.1.3.1.2 Long-term Effects

The proposed project will improve habitat access within the White River, while it is highly likely to further degrade access to Boise Creek. Removal of the dam will likely reduce wounding and death during passage, reduce opportunities for poaching, reduce or eliminate migration delays, and will improve the functional processes that maintain chinook habitat (i.e., channel migration) in the White River. An average of five percent of the chinook tagged for a recent radio telemetry study died at Tacoma's dam (Ladley et al. 1999; R. Ladley, email, August 15, 2001). Of the chinook salmon that pass the structure successfully, however, many have been observed at the Buckley trap with signs of fresh injuries that appeared to be caused by the rebar at Tacoma's dam. The proposed project will remove this source of injury, stress and mortality to chinook in the White River (see *Work Site Fish Exclusion and Handling*, next section).

The proposed project will alter the existing longitudinal profile of the White River channel, increasing the slope of lower Boise Creek (R2 Resource Consultants 2000). According to R2 Resource Consultants (2000) lower Boise Creek presently has a gradient of about 1.52 percent, measured between its confluence with the White River and Mud Mountain Road (S. Madsen, email, January 14, 2002). Removal of the dam will likely result in the rapid lowering of the bed of the White River between 2 to 4 feet (R2 Resource Consultants 2000). For the purposes of this analysis, NOAA Fisheries assumes that the project would likely cause the bed of the White River to drop by 4 feet. As a result, and with no change in the upstream base level, then the gradient of Boise Creek would increase to 2.21 percent, potentially impeding fish access, particularly during low flow (R2 Resource Consultants 2000; S. Madsen, email, January 14, 2002).

The rapidity of the channel bed changes would depend upon the magnitude and frequency of flood events that occur in the White River after the proposed project is completed. R2 Resource Consultants (2000) expects that the bed will re-equilibrate within 5 to 25 years after the dam is removed, and that the Boise Creek channel will not degrade more than about 500 feet upstream of the White River to Mud Mountain Road bridge (R2 Resource Consultants 2000). However, Tacoma proposes to monitor Boise Creek for up to 25 years or until equilibrium is reestablished (whichever is shorter) because the response of the channels cannot be accurately predicted (R2 Resource Consultants 2000).

If monitoring reveals that the channel changes are degrading passage into Boise Creek then Tacoma will install a temporary fishway (i.e., notched logs, boulder weir, concrete Denil ladder) until the channel reestablishes equilibrium. Tacoma proposes to install a temporary fishway in Boise Creek if the gradient increases 12% over a 100-foot length or if fish are delayed at the mouth of the creek. If necessary, a permanent, final solution will be identified in consultation with the Services, and State and Tribal agencies when the channel has reached equilibrium (R2 Resource Consultants 2000).

Nearly 300 chinook salmon have spawned in Boise Creek each year for the last five years. The project could seriously restrict access to chinook salmon that would use Boise Creek for spawning and rearing. Installation of one of the proposed structures should assist adult salmonids migrating upstream. In evaluating appropriate types of fishways, consideration should also be given to a structure that also maintains conditions adequate to pass upstream migrating juvenile salmonids. In other basins, low-gradient side channels fed by clear groundwater and valley-wall runoff provide critical non-turbid (or low turbid) habitat and are extensively used by chinook fry (Murray and Rosenau 1989; Chamberlain *et al.* 1991; Scrivener *et al.* 1994). Studies suggest that even nonnatal clear-water tributaries are used by juvenile chinook salmon and that these habitat types provide juveniles an opportunity to maximize their growth and survival through increased feeding success (Murray and Rosenau 1989). Based on these studies, NOAA Fisheries expects that juvenile chinook salmon from upstream areas may enter Boise Creek seeking refuge from high flows and high turbidity within the White River, although access for juveniles was likely degraded when the lower reach was modified. Excessive downcutting and fishways that prevent channel migration and natural processes could further impair already degraded channel conditions in lower Boise Creek where erosion and incision are evident.

2.1.3.2 Work Site Fish Exclusion and Handling

The project involves the isolation of a portion of the mainstem White River, requiring fish handling as the work area is isolated. Fish handling may also be necessary if problems arise with the temporary bypass channel, and as the bypass channel is dewatered and water is redirected into the White River. Generally, fish are excluded or handled to reduce or avoid their exposure to adverse conditions in the work area that could kill or injure them.

Even so injury and handling elicit stress responses in fish, which can lead to reduced disease resistance, reduced capacity for activity, increased oxygen consumption, decreased reproductive capacity, and death (Kelsch and Shields 1996). The proposed project minimizes the number of times fish are handled, but the cumulative effects of seining, capture, dewatering, transiting the temporary channel, confinement, hauling, and physical shock would likely result in sublethal harm to fish within the project area. When a fish is subjected to such stressors as handling, its metabolic demand changes, which can reduce its tolerance to other environmental variables like temperature.

Some fish will be harmed through handling, and some fish could die as a result of cumulative stressors (Wedemeyer et al. 1990). Given that the collection would occur in mid August, fish would likely be subjected to very warm temperatures, particularly as water depths become increasingly shallow in the dewatered area, which would increase their oxygen demand and reduce available energy. Tacoma intends to work quickly and is committed to having 16 people available during fish collection, which should expedite the return of fish to the river. However, the majority of the fish captured or otherwise removed from the construction area would likely enter the Buckley trap within a few days. Since multiple exposures to stressors can lengthen the time it takes fish to recover it is reasonable to expect that the added effects entering the Buckley trap after handling at the pipeline construction area could have a cumulative effect on stress levels (Clements et al. 2002; Kelsch and Shields 1996). While delayed death could occur after an otherwise seemingly healthy fish has been released, it would be difficult if not impossible to detect the number of fish that are killed from this effect.

For more than 50 years Tacoma's dam and fish ladder resulted in varying levels of stress, delay, injury and mortality of upstream migratory salmonids. Precise information on the injury rates that have occurred at the dam crossing are not available. We expect that injury rates have varied by flow level, potentially increasing with each year the dam has been in disrepair. Nevertheless, all fish depicted in the Buckley trap catches would have passed Tacoma's dam. The portion of the run that is injured or dies, either at the dam, or later may have been significant, particularly over the past 15 to 20 years as rebar exposure has increased at the crossing. The beneficial effects that the project will likely have on future successful chinook spawning over these years is expected to outweigh the nominal stresses that fish would endure from the collection and passage conditions resulting from construction activities.

2.1.3.3 Sediment Transport

The proposed project will affect fine and coarse sediment transport within the action area. Tacoma's existing dam affects aggradation and degradation of the channel for 750 feet upstream and about 900 feet downstream (R2 Resource Consultants 2000). The total volume of materials stored behind the existing dam is estimated at approximately 11,850 cubic yards (R2 Resource Consultants 2000). Removal of the structure will release this sediment, which largely consists of coarse material. The base level of the channel is expected to drop upstream of the existing structure and may be noticeable as far upstream as the PSE diversion, whereas downstream degradation and any sediment plumes that may occur during construction are not expected to extend further than two miles downstream of the existing structure. Degradation of the channel upstream of the pipeline is not expected to affect access to either the White River hatchery or the

Buckley fish ladders, which are located on the right and left banks, respectively (S. Madsen, pers. comm., 2002). However, as the channel redistributes sediments following dam removal, spawning and incubation success will be reduced in the action area. The speed of the channel readjustments will depend upon the magnitude and frequency of flood events within the action area. According to R2 Resource Consultants (2000) it could take up to 25 years for the channel to readjust to the new (no dam) condition.

2.1.3.3.1 Fine Sediment Transport

The project has the potential to adversely alter fine sediment transport in the action area, both over the short-term and long-term. Short-term effects of increased fine sediments are also discussed under habitat access. The use of heavy equipment and earth moving activities have the potential to increase fine sediment delivery to the White River and Boise Creek during construction activities. Summer construction activities, use of a coffer dam, and the implementation of an erosion and sediment control plan will minimize these effects.

The effect that the project would have on fine sediment transport over the long term will likely be minimal. Erosion of the cleared and graded areas could continue beyond the project construction, although the project proposes to use sediment controls, revegetate, and use mulch to reduce surface erosion from the site. The banks in the project area, however, will be vulnerable to erosion, at least initially, because the proposed construction activities will alter soil characteristics and remove vegetation. As a result, lateral erosion of the banks is likely to occur as the channel reestablishes equilibrium.

Removal of the dam is expected to largely affect coarse sediment transport in the action area. Excavation will likely leave small particles at the surface that will be mobilized relatively easily once the coffer dam is removed. R2 Resource Consultants estimates that the sediment plume that occurs with the removal of the cofferdam may be measurable for 2.75 miles (S. Madsen, email, May, 12, 2003). Turbidity in the action area, however, should quickly attenuate to background levels after the coffer dam is removed.

2.1.3.3.2 Coarse Sediment Transport

The dam currently stores about 11,850 cubic yards of sediment, roughly 4 to 6 feet high. When the structure is removed this material will redistribute, resulting in the rapid lowering of the bed upstream of the dam and aggradation of the bed downstream of the dam. According to HDR (1999), the channel downstream of the dam would likely aggrade for a couple of years, but then the channel is expected to degrade at a rate equal to the reach upstream of the dam. During this period of aggradation the bed level downstream of the dam is expected to rise two to three feet (HDR 1999).

The expected area of measurable changes in channel profile covers about three miles, from the PSE diversion to about 2 miles below the pipeline (HDR 1999). Based upon the flow return interval at which coarse sediment is generally mobilized, R2 Resource Consultants (2000) estimates that it will take between 5 to 25 years for the White River to re-equilibrate following removal of Tacoma's dam. As a result, spawning and incubation success of chinook salmon may be adversely affected in the action area for up to 25 years following removal of the dam (R2 Resource Consultants 2000).

Eggs deposited in this three mile reach may be buried by or dislodged as the bedload shifts, reducing survival rates of chinook salmon spawning in the action area. Redds may be scoured and filled within the action area as coarse sediment is mobilized. Fine sediments mobilized by the project may also reduce incubation success through the filling of interstitial spaces within redds, which in turn could reduce intragravel flow, as well as act as a barrier to emergence (Spence *et al*.1996). Physical changes in the bed form and shifting of sediments should diminish over time and with each high flow event. Similarly, the loss of eggs and alevin would likely be greatest with the first flood event after construction, diminishing thereafter.

Data on the average number of chinook that use the action area for spawning and rearing are limited. Surveys in the three mile reach directly affected by the project suggest very low redd densities for chinook (two to seven redds per mile). A comparison of this data to that collected by the Muckleshoot Indian Tribe for the lower river, suggests that it might severely underestimate the number of chinook that would spawn in the action area. Surveys are generally conducted over extensive distances and were primarily limited to the mainstem White River. Surveys conducted in downstream reaches by the Muckleshoot Indian Tribe have established chinook salmon redd densities as high as 113 redds per mile in the mainstem and more than 250 redds per mile when side channel habitat was included (Malcom and Fritz 1999). It is impossible to know with any certainty how many redds could be affected by Tacoma's action. Flows capable of moving bedload occur roughly on a 2-year return interval (R2 Resource Consultants 2000). In any case, survival of chinook salmon that spawn in the action area will not be affected to the same degree throughout the entire action area. More likely, the redds in the most tenuous position will be those nearest the head-cut as it travels upstream. Mortality will likely be highest at this point and progressively diminish downstream away from the head-cut. Mortality, as with the amount of material moved, will also vary by year and flow, diminishing over time.

2.1.3.4 Pools and Side-channel Habitat

The existing dam affects channel morphological features through local flow dynamics, and the development of habitat units (i.e., pools, glides, riffles) within the action area. Removal of the dam will result in reworking or shifting of habitat units, similar in some ways to that which might occur during a large flow event or mass wasting event. R2 Resource Consultants (2000) suggests that the overall pool-riffle to braided channel morphology is not expected to change as the river reestablishes grade. This is primarily because valley and reach level morphology is influenced by climate and geology (Montgomery and Buffington 1993), not the project. Sediment transport processes within the action area are influenced by Tacoma's dam and its removal will alter the abundance and character of channel habitat units (the pool to riffle ratio) in the action area, as well as alter local hydraulic and current complexity (Spence *et al*. 1996). NOAA Fisheries expects that in the short-term the project will adversely affect pool quantities in the construction area. However, as a mitigative action Tacoma is installing five LWD jams, each with three key structural pieces.

R2 Resource Consultants (2000) anticipates that aggradation is likely to expand the existing cobble bars immediately downstream of the project, and that the large right bank scour pool downstream of the dam will fill as sediment redistributes. This large pool is associated with the dam and has previously been a source of significant fish kills, as fish have been trapped within the pool when sudden changes in flows occurred as a result of upstream hydropower operations. Of the remaining pools surveyed below the Tacoma's dam, three are associated with fixed obstructions, such that infilling that occurs should be temporary or limited. For instance, R2 Resource Consultants (2000) anticipates that substantial aggradation is likely to influence only the two pools formed by meander bends, roughly 1.0 and 1.5 miles below the dam. According to R2 Resource Consultants (2000) these pools are formed by regular bedform oscillations, so that the wave of sediment is likely to have a temporary affect on pool volume. While temporary, the effect could last for several years depending upon flows (HDR 1999). The abundance and quality of pool habitat may be significantly reduced in the action area for the period from dam removal to high flows of sufficient duration that will fill and subsequently scour pools associated with meander-bends, large rocks, and LWD jams.

Generally, early-run chinook inhabit pools during their upstream migration and holding period. Deep pool habitat, which provides important resting areas to migrants and could provide some thermal relief from warm mainstem waters, is limited in the action area. Large pools are also particularly important to juvenile and adult chinook salmon. Pools provide deep areas to hide from predators, low velocity resting areas, and areas of thermal refugia (Reeves *et al.* 1991). In fact, pools are generally the most productive rearing habitat available to juvenile salmonids (Sedell and Everest 1991 *in* Spence et al. 1996). Pools also provide thermal and metabolic refugia for adult chinook prior to spawning (Bermann and Quinn 1991). Although Ladley *et al.* (1999) did not find White River chinook holding for extended periods within the bypass reach, this behavior may be an artifact of the degraded pool condition throughout the reach.

Removal of the dam is also expected to alter side channel habitat within the action area. According to R2 Resource Consultants (2000), the four side channels identified downstream of the structure may transmit flows on a more frequent basis after dam removal as a result of increases in water surface elevation from aggradation. Further, shifts in bedload may reduce the connectivity of side channels upstream of the dam (R2 Resource Consultants 2000). Evidence suggests that side channels are important for chinook salmon spawning and incubation in the White River, and that the density of chinook spawning in side channel habitat is significantly higher than the mainstem (Malcom and Fritz 1999). Increases in flows in side channels downstream of the dam could result in a variety of effects ranging from beneficial to adverse. Side channel habitat would be subjected to scour and deposition until some equilibrium is reached throughout the reach.

The addition of structural complexity (i.e., the five LWD jams) should help minimize the loss of pool habitat, reduce erosive forces on the raw banks areas, and retain gravels. The LWD jams are expected to shift as the channel shifts. However, the key pieces will all have large root wads that should increase stability of the wood, as well as provide habitat complexity important for juvenile chinook salmon. The addition of the wood and temporary aggradation could also initiate formation of new side channel habitats (R2 Resource Consultants 2000; Bryant 1980). It is difficult to predict the overall effect that the project will have on the complex interactions that govern pool frequency and quality, and off-channel habitat formation and stability. Microhabitats will be in flux for at least the first few bank-full flow events. The retention of wood from the project site and replanting of the cleared areas will also help alleviate the potential effects of bank erosion. Thus, NOAA Fisheries expects that short-term changes in these indicators may be adverse, but that over the long-term the project will maintain, and possibly improve these indicators of functional chinook salmon habitat.

2.1.3.5 Large Woody Debris and Riparian Vegetation

Construction activities will result in the clearing of about 4.5 acres of floodplain wetland and riparian vegetation. As a result, the project will reduce the amount of recruitable wood from these areas over the short-term. Over the long-term, the floodplain wetland and riparian vegetation, both indicators of functional chinook salmon habitat, are expected to improve through the replanting of a variety of long-lived, large tree species, such as Douglas fir and western red cedar. Although there remains a temporal loss in the functions that the wetland and riparian vegetation provided, these functions will continue to improve as the vegetation grows.

Performance standards for the restoration of the wetland and riparian vegetation are outlined in the BA. In general, Tacoma proposes to monitor plantings for 5 years following construction. If mortality exceeds 10% in year 1, 20% in year 3, or 50% in year 5 then the site will be replanted. This may, however, be insufficient to evaluate revegation. According to a recent publication by the National Research Council (2001) functional performance criteria for vegetation growth is frequently based on insufficient time frames (usually 5 years) to evaluate success. National Resource Council (NRC) suggested that longer-term management may be necessary, as it may take some sites up to 20 years to achieve functional goals.

All trees removed with the construction would be retained on site, and Tacoma will install five LWD jams within the wetted channel of the White River. Most of the trees in the project area are too small to be considered key LWD pieces and are not expected to remain in place, and depending upon the flows, the jams could move considerably as well. Nevertheless, the wood should be recruited by downstream LWD jams, perhaps increasing the size and complexity of existing jams. Most of the trees cleared from the construction site consist of red alder. Alder has a relatively short life span in the channel compared to conifers (Cederholm et al. 1997) and thus any beneficial effect would likely be short-lived. However, the rapid decay of the alder could also temporarily boost aquatic insect production, potential prey for juvenile chinook salmon, in the action area. The increase in wood in the action area may create pockets of hydraulic complexity, and could improve channel sinuosity or aid in the development of off-channel habitat (discussed previously). Overall, the floodplain vegetation should incrementally improve over the long-term as a result of the new plantings.

2.1.3.6 Streambank Condition

The project will alter 450 linear feet of stream bank on each side of the White River through clearing and grading, and trench excavation. In the short-term, streambank condition will be degraded as a result of the excavation and the loss of stabilizing features like tree roots. R2 Resource Consultants (2001b) anticipates that the area with the highest potential for erosion is immediately upstream of the dam, where the redistribution of stored material is likely to lower the channel profile, which would indirectly undermine the banks. After considerable discussion with the Services and others, Tacoma has redesigned their project to incorporate bioengineered approaches to restoring the streambanks after the pipeline is replaced. The bioengineered approach would result in an increased potential for erosion along the raw banks as the river readjusts. However, a bioengineered approach would allow for a more dynamic interaction between the river and the bank, increasing the functional habitat for salmonids in the area over time.

2.1.3.7 Water Quality

The proposed action will likely have an incremental adverse effect on the following water quality indicators: sediment/turbidity and chemical contamination. However, the project minimizes these effects through monitoring and preventive measures. Water quality could be adversely affected through the remobilization of fine sediment stored in the channel and erosion of cleared and graded areas that deliver sediments to the White River (R2 Resource Consultants 2000). Although Tacoma proposes to monitor turbidity daily at the site to ensure increases remain below state standards, NOAA Fisheries has not yet determined the adequacy of those standards for avoiding jeopardy and adverse modification of chinook salmon habitat. Even in a glacial system like the White River increases in sediment yield can have adverse effects on fish habitat. Evidence suggests that fish density is naturally lower in glacial systems than would be expected in clear water systems, indirectly resulting from sediment concentrations and duration (Newcombe and Jensen 1996). Activities that increase the natural loading of sediment can indirectly influence productivity, cause changes in migratory behavior, reduce light penetration and the reactive distance of foraging fish, and reduce survival and emergence of alevin (Spence et al. 1996). However, the project contains several measures aimed at reducing this potential adverse effect, such that NOAA Fisheries does not expect prolonged or extensive changes in turbidity during construction.

The use of heavy equipment in the channel also has the potential to increase pollutants through fuel spills or leaks. Tacoma proposes to steam clean and inspect equipment to minimize potential adverse effects on water quality from fuel leaks and delivery of grease from dirty equipment operating in or near the water. NOAA Fisheries expects that this will minimize the effects of the proposed action on chinook salmon and their critical habitat. As a general matter, when pollutants (e.g., metals, PAHs and other pollutants) enter streams, water quality degrades and biological oxygen demand is increased. As a result, lethal or sublethal effects may occur (NRC 1996). While NOAA Fisheries does not expect episodes of acute exposure, NOAA Fisheries believes it is possible some juvenile chinook in the action area may be exposed to small amounts of pollutants (e.g., ionic copper, or PAHs), which could increase susceptibility to infection and possibly predation (NRC 1996).

2.1.3.8 Flow Coordination

The PSE maintenance activity has independent utility and would have occurred regardless of whether Tacoma's project was constructed; however, Tacoma's project affects the timing of PSE's routine maintenance outage. This shift in timing results in fish encountering flow changes two weeks earlier than they would have under a typical regulated regime. We expect that this change in flow timing would result in discountable effects over that which would normally occur as a result of PSE's annual outage maintenance. Take of juvenile chinook salmon during this event is expected under the terms of the FERC consultation with NOAA Fisheries on the PSE diversion.

The bypass reach of the White River is occasionally a fully regulated river, often a partially regulated river, and sometimes an unregulated river. The regulatory mechanisms are PSE's diversion dam, the COE's Mud Mountain dam, and natural streamflow. As a consequence, fish habitat, particularly suitable juvenile rearing habitat, is quite literally a moving target between the low, regulated minimum instream flow of 130 cfs, intermediate flows, and much higher unregulated flows from 1,000 cfs up to 8,000 cfs. As flows increase, the main channel velocities increase, forcing many juvenile chinook salmon to seek refuge in protected side channels. Connectivity between the main and side channel habitat provides important refuge habitat. Fish that move to these areas must not be stranded when flows recede as unregulated flows return to the regulated minimum instream flows. One such flow event occurred during the spring of 2003 during peak outmigration of salmonids from the basin. The number of juvenile salmonids stranded during this event may have been was on the order of 10,000 to 100,000.

Typically, PSE's maintenance outage occurs when the vast majority of juvenile chinook have outmigrated and adult salmonids are returning to spawn. The altered timing for this flow change may even improve conditions for adult salmon upstream migration because water depth should increase within the bypass reach, which has been identified as significant problem during the month of July (NOAA draft Opinion 2002).

The COE action is intended to facilitate the change in PSE's annual maintenance. As PSE begins maintenance, then flows in the bypass reach shall return to an unregulated condition. If however, flows are above the threshold identified by PSE then the COE would regulate flows to typical flows for the month of August. We expect that the incremental effect of this flow control by the COE would largely be masked by the change in flow resulting from the PSE action. However, as the water is released there may be a brief period when suspended sediment levels are elevated in the White River. We expect that this sediment plume would be of short duration largely because water storage would also be short and would likely result in minimal sediment accumulation behind the dam. The effects of the sediment plume may range from no detectable change to incremental adverse effects on foraging juvenile chinook salmon. If a plume results, most or all of it should settle within the reach between Mud Mountain Dam and PSE's diversion.

2.1.4 Cumulative Effects

Cumulative effects are defined as those effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this Opinion (FWS and NOAA Fisheries 1998; 50 CFR. 402.02). Future Federal actions, including the ongoing operation of the hydropower dams, that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

In general, activities and land uses within and affecting the action area range from rural and agricultural to dense urban development. While the cities of Buckley, Sumner, Tacoma, and Enumclaw are outside of the action area, their activities affect the quality of salmonid habitat within the action area. Perhaps the most important cumulative effect is the continued residential, urban, and industrial development of the White River Watershed. Over the last 10 years, the Puget Sound lowlands have displayed a pattern of rapid urban expansion. The relatively short distance from the White River watershed to the major urban centers of Seattle and Tacoma inevitably lead to continued development in the area.

The Puget Sound Regional Council predicts that between 1998 and 2030 there will be a 37% increase in population in the lower White River Watershed (excluding Tacoma) increasing from 210,000 in 1998 to 330,000 in 2030 (PSRC 2001). Expected effects of development include those that directly affect the White River itself and those that affect the watershed. Changes to the river and the watershed affect the capacity of the White River to fulfill the biological requirements of chinook salmon. For instance, the White River currently receives sewage treatment effluent from the cities of Enumclaw, Buckley, and Sumner. The Buckley and Enumclaw treatment plants discharge directly into the bypassed reach. The predicted population increase in these cities of 20% between 1998 and 2030 (PSRC 2001) will likely cause increased load on the sewage plants, depending on the conditions of the water quality permits that control those discharges. The reduced flows of the bypassed reach are unlikely to absorb this increased load without catastrophic degradation of water quality.

In addition to (and seemingly contrary to) increased demand for water to dilute and carry away wastes is increased demand for water for consumption. Modifications to the watershed associated with development including paving, increased drainage network, loss of forest and riparian vegetation, and road building are associated with increased non-point source pollution, sedimentation, increased water temperatures, and reduced flows. The likely effects of continuing development of the watershed are degraded water quality, increased water temperatures, and reduced flows.

2.1.5 Integration and Synthesis of Effects

The following discussion summarizes the probable risk that Tacoma's pipeline and dam removal project poses to threatened Puget Sound chinook salmon.

Tacoma's pipeline crossing has maintained salmonid habitat in a degraded condition for as many as 91 years since it was first installed shallow in the bed of the White River. As part of the existing baseline, the crossing is a likely source of migratory delay, injury, and mortality to Puget Sound chinook salmon. At RM 23.3, a substantial portion of White River chinook salmon must migrate over the structure to reach their spawning grounds.

Removal of the grade control dam will have adverse effects on chinook salmon and their habitat. The intensity of the harm would vary over time, and ranges from sublethal exposure to changes in water quality during construction, to potentially persistent sources of surface erosion for years following construction, and major changes in sediment transport affecting about three miles of chinook salmon spawning and rearing habitat. Within the three mile zone most affected by sediment transport, harm to spawning habitat is likely to be substantial to the White River chinook population. Bedload changes would occur within the first few bank-full flow events. In these years success of developing eggs, embryos, and alevins to be substantially affected, with the amount of mortality diminishing with each subsequent flood season.

During construction activities, about 45% of the returning adult White River chinook salmon would be exposed to temporary conditions resulting from Tacoma's project as they migrate through the project area. According to 2002 returns at Buckley and the geometric mean of spawner abundance calculated by the BRT (2003), 45% would range from a little more than 300 to 500 adult chinook salmon passing through during construction. For the vast majority of these fish, conditions within the bypass channel would represent an improvement over passage at the degraded dam structure and fewer fish should have notable injuries as they return to the Buckley trap. Based upon available evidence of the design and the swimming speeds and abilities of chinook salmon, the majority of adult chinook should pass by the project area relatively unimpeded. Further, Tacoma has built in reasonable responses to detect and rectify problems with adult passage if they occur.

Only a small fraction of these fish would be in the project reach during dewatering. Fish in the construction area during dewatering would be exposed to sublethal stressors resulting from the harassment of herding them out of the area and others would move out volitionally as the area is slowly dewatered. A smaller portion of these fish may become stranded in the work area and would require handling by Tacoma and their crew of 16 fish salvagers. During this collection, adult fish may be exposed to high temperatures, internal injury from rough handling, and other stressors associated with collection and dewatering. Recovery for some of these fish may be slow, and many may not fully recover before they endure additional stressors at the Buckley trap. We expect that a small, but undetermined portion of these adults may die at the construction site, or fish may die later as a result of exposure to successive stressors. A portion of the fish that are encountered in the project area as it is dewatered would likely be juvenile chinook salmon. The number of juvenile chinook would be relatively low because the vast majority are believed to outmigrate as young of the year in the spring, or may seek side channel habitats not in the immediate project area. However, they may concentrate in the two large pools found in the construction area.

While the effects of the project construction would likely be substantial, we expect that the beneficial long-term affects outweigh the affects of the dam's removal. Migratory delay and low level stress from passage have likely resulted in sublethal harm to White River chinook for more than 80 years. In more recent years, injury rates as high as 50% may have contributed to substantial prespawn mortality. Although we have no evidence to suggest how much of a problem prespawn mortality is to White River chinook salmon, research on stress and injury suggest that mortality and reduced spawning success are likely as a result of these injuries. Evidence exists that the dam provides poachers an opportunity to illegally harvest migrants. Since the entire segment of the population that is used to calculate long-term trends of White River chinook salmon must pass over this dam on its way to spawn, we believe this barrier likely substantially affect their numbers and reproductive success. Its removal is expected, over the long-term, to improve habitat function and improve population viability.

2.1.6 Conclusion

After reviewing the current status of threatened Puget Sound chinook salmon, the environmental baseline for the action area, the effects of the proposed project, its interrelated and interdependent actions, and the cumulative effects, it is NOAA Fisheries' biological opinion that Tacoma's project may adversely affect, but is not likely to jeopardize the continued existence of the Puget Sound chinook salmon ESU.

2.1.7 Reinitiation of Consultation

Consultation must be reinitiated if the amount or extent of take specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). If minimization measures or habitat enhancement measures described as part of the project and in this Opinion are not completed, then this would constitute new information that could effect the listed species in a way not previously considered, and may require that the COE must reinitiate consultation.

2.2 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to Section 4 (d) of the Act prohibit the take of endangered and threatened species without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined as significant habitat modification or degradation that results in death or injury to listed species by "significantly impairing behavioral patterns such as breeding, spawning, rearing, migrating, feeding, and sheltering" (50 CFR 222.102). Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant/grantee carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of the agency action is not considered prohibited taking, provided that such takings is in compliance with the terms and conditions of this incidental take statement.

An incidental take statement specifies the effects of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize take and sets forth terms and conditions with which the action agency must comply to implement the reasonable and prudent measures.

2.2.1 Amount or Extent of Anticipated Take

Juvenile and adult Puget Sound chinook salmon are expected to use the action area and the project area throughout the duration of construction. As stated previously, the project would occur during the upstream migration of an estimated 300 to 500 adult White River chinook salmon. The area is also used by White River chinook for spawning, incubation, and rearing. Therefore, take of Puget Sound chinook is reasonably certain to occur.

Take caused by the proposed action is anticipated in the form of harm, where habitat modification will kill or injure chinook by significantly impairing essential behavioral patterns, including spawning, migration, feeding, sheltering and rearing. Harm is likely to result from injury from work site exclusion, changes in sediment transport, reductions in spawning and rearing habitat. This Opinion does not exempt any take that might occur from the interrelated action to repair fish access into Boise Creek.

The anticipated level take associated with the isolation of the work area was estimated using the following assumptions: (1) the close proximity of the project area to the Buckley trap makes daily catch a fair surrogate for understanding how many adult chinook would be in the project reach; (2) no more than 200 juvenile chinook are likely to be captured; (3) 75% or more of the fish present would likely move out of the area with receding water and would not require handling; and (4) 95% or more are expected to survive with no long-term effects and five percent or less are expected to be injured or killed, including delayed mortality because of injury. Buckley trap data for August, for the years 1999 to 2001, indicate that on average fewer than 50 chinook salmon are counted each day, ranging from zero to nearly 100. Assuming that two days catch would be represented in the work area during dewatering, Tacoma may encounter up to 200 adult chinook. If 75% of these move out with receding waters or seine sweeps, then fewer than 50 adult chinook and 200 juvenile chinook salmon would be handled during initial project construction. Of these, less than five percent would be expected to die from handling and stress, including delayed mortality after released (three adults, 10 juveniles). Monitoring of take from handling would be compared with this estimate.

The greatest potential for take would result from changes in the channel profile that reduce spawning success. Because we have a general idea of where the spawning would occur, and that fish would be in the reach as the project is constructed but cannot specify the exact numbers, we cannot estimate the amount of take of individual fish. Therefore, we use a surrogate approach to estimate the extent of take of Puget Sound chinook salmon that would occur as a result of the construction of this project. We expect all chinook eggs between RM 24.4 and 20.5 would be killed by the proposed action during the first year. This estimate is based on the extent of effects from channel regrading, which we expect would affect the spawning and incubation success of chinook salmon in this reach. After which the extent of eggs and embryos harmed through major channel changes would diminish with time and high flow events, but as a worse case, harm may persist at reduced levels for up to 25 years based on an estimate by R2 Resource Consultants of the length of time that it may take for the White River to re-equilibrate following removal of the dam (see *Coarse Sediment Transport*).

As part of the existing baseline, NOAA Fisheries expects that the project already exhibits a level of adverse effect measurable at the population level. Construction of the proposed project, in particular removal of the grade control dam, will result in reduced levels of injury, mortality, delay and other forms of harm such that the long-term benefits to the entire White River chinook salmon population enumerated at Buckley, outweighs the short-term losses of construction.

2.2.2 Reasonable and Prudent Measures

The reasonable and prudent measures described below are necessary and appropriate to minimize amount or extent incidental take of Puget Sound chinook salmon resulting from this project. These measures are non-discretionary and must be binding conditions of the COE's permit in order for the exemption in section 7(a)(2) to apply. The COE has the continuing duty to regulate the activities covered in this incidental take statement. If the COE fails to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

The COE shall ensure that Tacoma:

1. Minimizes take of chinook salmon trapped within the construction area or migrating through the action area during construction activities.

2. Minimizes take of chinook salmon from changes in habitat access, riparian vegetation and LWD, substrate, and other indicators of functional chinook habitat in the White River and Boise Creek.

3. Monitors implementation and effectiveness of all conservation measures described in the biological assessment, the monitoring and contingency report, as well as the aforementioned Reasonable and Prudent Measures and their accompanying Terms and Conditions.

2.2.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the COE and Tacoma must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To implement Reasonable and Prudent Measure No. 1, the COE will ensure that:

   a. Chinook salmon will be handled with extreme care, and all handling should be minimized to maximum extent possible. All fish handlers must be equipped with gloves to improve grip and minimize injury to fish during handling, and should be skilled in identification of Pacific salmon, by species, at adult and juvenile life stages.

   b. Electrofishing, as a collection method, is conducted only as a last resort under the following conditions: herding and seining has been repeatedly tried; adults are believed to be out of the area of influence and only juvenile remain in the large pools or other deep water areas; and water clarity is sufficient to detect fish as they are stunned. Electrofishing, if any, shall be conducted according to NOAA Fisheries guidelines (NMFS 2000).

   c. Chinook salmon will be provided adequate holding and transportation conditions, and crowding shall be minimized. Tacoma shall have a tanker truck or other large suitable container on site for transporting adult chinook upstream when the White River is dewatered.

   d. Dewatering and fish collection activities must begin at daybreak in an effort to minimize or complete fish handling before the hottest time of the day.

   e. All adult chinook salmon handled must be counted and recorded. All juvenile chinook salmon must be counted and recorded to the maximum extent practicable, without delaying their return to the river. If necessary, a reasonable sample could be made to estimate the relative proportion of chinook salmon to other salmonids. Weights, lengths, or other indices of condition are unnecessary, and their collection could prolong fish return to the river.

   f. Tacoma pumps down the water levels in the scour holes to facilitate recovery of fish. Adequate pump capacity shall be available on site. All pumps shall be screened, and the screens shall be checked hourly to ensure that they are functioning properly, clear of debris and are not entraining fish. Should fish become entrained, then the pump shall be turned off immediately, and actions must be taken to reduce the potential for entrainment, such as moving the screen further away from the pump.

   g. As the work area is dewatered and fish recovery begins a block net must be installed upstream of the upper cofferdam to minimize the risk that fish would fall back into the work area.

   h. In the unlikely event that construction monitoring reveals significant reductions in adult chinook salmon returns to Buckley, or that passage in the bypass channel is otherwise impaired, Tacoma shall install a temporary upstream live trap to improve capture efficiency. The live trap would be installed in addition to netting fish below the work area. The trap must be checked daily and any adults collected in the trap will be transported upstream of the work area by vehicle. If it becomes necessary to install a live trap, Tacoma will work with NOAA Fisheries, the COE, and the Tribes to determine the best configuration of the trap facility.

i. To reduce the potential for adverse effects on water quality, Tacoma shall commit to the following provisions: (1) all heavy construction equipment must be clean prior to operation in or near the White River, Boise Creek and associated wetlands; (2) hydraulic machinery shall use non-toxic hydraulic fluids when operated in or near the White River, Boise Creek and associated wetlands; (3) all refueling areas will be located in a previously approved location or otherwise 300 feet or more from all sensitive aquatic areas, including the White River, Boise Creek, and their associated wetlands; and (4) refueling areas must be diked and lined to prevent spillage into sensitive areas.

j. Sediment/turbidity shall be monitored when the cofferdam is removed from the construction area, and during evacuation of the Mud Mountain dam pool. Tacoma and the COE shall work with NOAA Fisheries to determine the monitoring approach and location.

2. To implement Reasonable and Prudent Measure No. 2, the COE will ensure that:

a. Barrier fences are installed along the clearing limits to delineate protected areas. Fences must be located outside of the drip line of any mature trees to be retained on site.

b. Where disturbance or vegetation removal is necessary, then Tacoma will ensure that trees are pushed over or dug-out to retain as much of the root structure as possible. Trees greater than 8 inches and longer than 36 feet will be distributed as follows: Two-thirds of the wood will be distributed as proposed in the biological assessment, and one-third will be distributed within 50 feet of the banks to be recruited over time as shifts in the channel occur.

c. If planted areas are not meeting performance criteria for vegetation growth, the monitoring and replacement regime will be continued for another 5 years, or until performance criteria are met.

d. All LWD shall be in the construction area shall be inventoried, collected, and returned to the site following construction activities. Tacoma shall provide NOAA Fisheries with a copy of the tree inventory, before construction begins.

e. Five wood jams, each with three key pieces and no less than four rack members shall be installed in consultation with the Services and the Tribes. The COE shall supplement Tacoma's wood jams, to the extent practicable, with additional wood from that which collects behind Mud Mountain dam.

f. Tacoma uses bioengineering bank stabilization techniques to restore the White River shore. Native rock, removed from the trench, may be placed along the banks and floodplain in cooperation with the Services. Final bank stabilization must provide stability for riparian conditions to improve, but must not be designed to prevent a range of natural channel changes.

g. Tacoma develops and implements plans in cooperation with the Services for monitoring long-term changes in channel profile and the restoration of fish passage in Boise Creek and the White River. A current set of transects of the White River channel, in similar locations as that used in the scour analysis, must be taken before construction begins. Monitoring of the White River and Boise Creek would continue until they are determined to have reached equilibrium or for 25 years, whichever is greater.

h. Short- and long-term fish passage in Boise Creek shall be evaluated for all relevant life history stages of chinook salmon, including upstream migrating juveniles. If monitoring reveals passage problems then Tacoma shall develop plans in coordination with NOAA Fisheries to restore passage. Plans to restore fish passage must be submitted to NOAA Fisheries for review prior being submitted to the COE.

i. Pool habitat and side channel condition shall be monitored upstream and downstream of the crossing to determine the short and long-term effects of the proposed project.

3. To implement Reasonable and Prudent Measure No. 3, the COE will ensure that:

a. A report is prepared containing as built plans for the channel reconfiguration, bank stabilization, LWD clusters, and describing the progress of the proposed pipeline construction. The report shall be submitted to NOAA Fisheries within six months of completing construction and planting. The report shall also describe adverse effects of construction and implementation, when and if the level of incidental take is approached or exceeded, and the implementation and effectiveness of the minimization measures used during construction and the terms and conditions of this Opinion.

b. Provide implementation and monitoring reports for all conservation measures described in this Opinion, the biological assessment, and the monitoring and contingency plan. Where long-term monitoring will occur (Boise Creek, wetlands, and riparian vegetation) annual reports shall be submitted to NOAA Fisheries no later than March 1 for the preceding 12-month period ending December 31.

c. All reports shall include a description of the implementation and effectiveness of the appropriate terms and conditions (50 C.F.R. §402.14(I)(3)). The reports shall a) confirm the implementation of each term and condition; and b) describe the effectiveness of the terms and conditions.

d. In addition, NOAA Fisheries is to be notified within three (3) working days upon locating any dead, injured, or sick chinook salmon. Care should be taken in handling dead specimens to preserve biological materials in the best possible state for later analysis. In conjunction with the care of sick or injured chinook salmon, or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Initial notification must be made to NOAA Fisheries's Law Enforcement Office at (800) 853-1963. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. NOAA Fisheries' Habitat Conservation Division should also be notified at (206) 526-6146.

3.0 MAGNUSON-STEVENS FISHERY CONSERVATION MANAGEMENT ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));

- NOAA Fisheries must provide conservation recommendations for any Federal or State activity that may adversely affect EFH (§305(b)(4)(A));

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the effect of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies regarding any activity that may adversely affect EFH, regardless of its location.

The objective of this EFH consultation is to determine whether the proposed action may adversely affect designated EFH, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse impacts to EFH resulting from the proposed action.

3.2 Identification of Essential Fish Habitat

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally-managed Pacific salmon: chinook; coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*)(PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the proposed action is based on these descriptions and information provided by the COE.

3.3 Proposed Actions

The proposed action is detailed above in *Section 1.0* of this document. The project affects EFH for various life-stages of chinook, coho, and Puget Sound pink salmon from RM 24.3 to 20.5 of the White River. The area affected extends upslope at the construction site (RM 23.3., 2.4 acres on the south bank and 2.1 acres on the north bank), and includes the lower 500 feet of Boise Creek (RM 23.9).

3.4 Effects of Proposed Actions

As described in *Section 2.1.3* these activities may result in detrimental, as well as beneficial, short- and long-term effects on the designated EFH for Pacific salmon. The proposed project would adversely affect spawning and incubation habitat, while improving habitat access and other essential features of Pacific salmon habitat. The action would:

1. Affect short-term and long-term habitat access in the White River and its tributary Boise Creek. Short-term effects may include changes in channel gradient, suspended sediment concentrations, and hydraulic complexity. Long-term effects may include changes in hydraulic complexity and the longitudinal profile in the White River and Boise Creek that inhibit fish passage.

2. Affect sediment transport which may in turn adversely affect water quality, spawning and incubation success, the distribution of habitat elements including pool frequency and quality, and side channel habitat.

3. Affect LWD and riparian vegetation within the action area through construction activities and indirectly as the channel reestablishes equilibrium.

4. Affect streambank condition through construction activities and indirectly as the channel reestablishes equilibrium.

5. Adversely affect water quality during construction activities through chemical contamination and changes in suspended sediment concentrations.

3.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect designated EFH for Pacific salmon.

3.6 Essential Fish Habitat Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries acknowledges that the conservation measures described in the biological opinion will be implemented by the COE, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. Consequently, NOAA Fisheries has the following EFH conservation recommendations that, if implemented, will minimize the potential adverse impacts of the proposed project and conserve EFH:

1. To minimize adverse effects No. 1 short and long term effects on access), the COE should implement the following:

a. Install LWD jams to minimize channel shifts that degrade access.
b. Evaluate and repair habitat access if it becomes degraded from shifts in channel profile.
c. Minimize changes in suspended sediment levels resulting from project activities.

2. To minimize adverse effects No. 2 and 3 (effects sediment transport, water quality, pool frequency and quality, side channel habitat, LWD and riparian vegetation) the COE should:

   a. Ensure large trees are pushed over or dug-out and retained on site, with as much of the root structure as possible.
   b. Inventory and retain all LWD on site.
   c. Ensure LWD jams are installed, and supplemented with additional wood available at Mud Mountain Dam.
   d. Install barrier fences along the clearing limits to delineate protected area. Fences should be located outside of the drip line of any mature trees to be retained on site.

3. To minimize adverse effects No. 4 (effects streambank condition) the COE should:
   a. Use bioengineering bank stabilization techniques to restore the White River shore.
   b. Place native rock, removed from the trench, along the banks and floodplain. The exact location of which should be determined in cooperation with NOAA Fisheries.

4. To minimize adverse effects No. 5 (water quality), the COE should:
   a. Ensure that water quality is monitored at all discharge points, and above and below the project area.
   b. Minimize pool storage at Mud Mountain Dam to the maximum extent practicable.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. In the case of a response that is inconsistent with the EFH Conservation Recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The COE must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(l)).

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